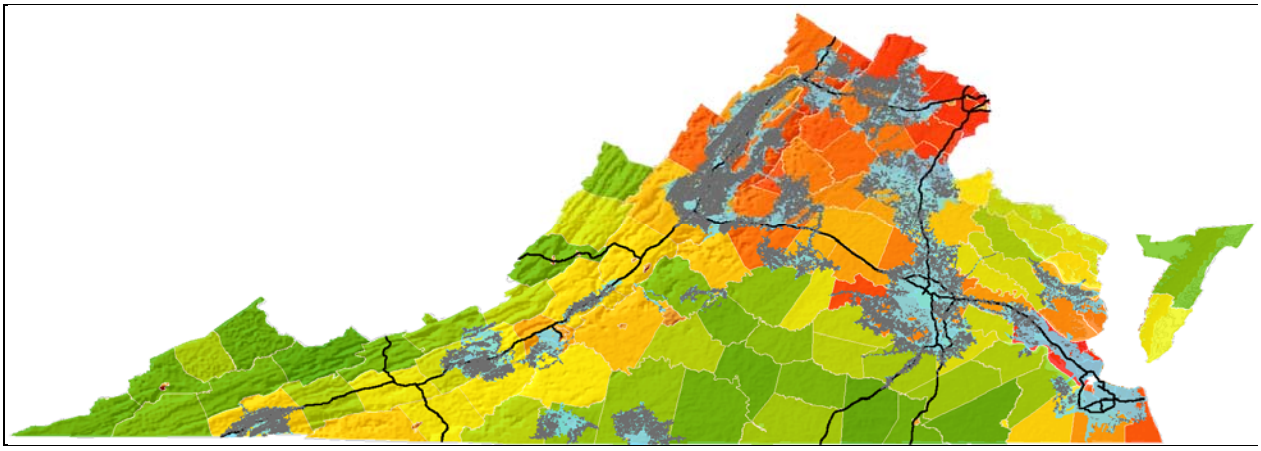
Natural Resources Conservation Service

Virginia

Farm and Ranch Land Protection Program

2012 State Plan



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Natural Resources Conservation Service
Virginia State Office
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Contents

1. **State Plan Narrative**
    - I. **Introduction**
    - II. **Virginia Land Conservation**
    - III. **Farm and Ranch Lands Protection Program Priority Areas**
    - IV. **Justification of Funding Request**
2. **State Plan Summary**
3. **State Plan Required Content**
4. **FRPP Priority Area Map**

Appendix

1. **Composite Vulnerability Model**
2. **Participating Entity Information**
3. **Virginia 2012 Draft FRPP Ranking Factors**

I. Introduction

This Farm and Ranch Lands Protection Program (FRPP) state plan is approved by the State Conservationist to guide the FRPP program in the Commonwealth of Virginia. The plan supports Virginia's budget allocation request of $4,841,142.

There is great potential for farmland preservation in Virginia in fiscal year 2012. In 2011 the Commonwealth of Virginia spent over $106 million on land conservation in the state, however little of it was eligible for match against Farm and Ranch Lands Protection Program (FRPP) funds under the 2008 Farm Bill. This investment by the state will only grow in 2012 and if the next Farm Bill recognizes this commitment to conservation then NRCS could play a larger role in guiding it towards farmland preservation through FRPP.

This $106 million expenditure preserved over 60,000 acres with a fair market value exceeding $271 million. It also created a stewardship fund of an estimated $2 million targeted at the long term monitoring of those 60,000 acres. In 2008, the most recent year for which statistics are available, these funds protected 20,393 acres of land in agricultural use.

This is such a major investment by Virginia that the projects with the highest fair market value are required to go through an independent review by the State's Department of Conservation and Recreation. This independent review frequently requires additional protections for the resources targeted by FRPP, including conservation plan requirements, prohibitions on development of prime farmland, and riparian buffers.

Unfortunately, none of these funds was eligible as match against FRPP, since they were an indirect expenditure through a state tax credit. Because of this limitation, there were only $600,000 dollars of Virginia state funds available to match against FRPP in 2011, and the majority of these funds were held over to 2012 when they could be bundled with new funds.

Unless NRCS is allowed to tap into and steer a portion of this $106 million investment by using it as match for FRPP, then we must continue to base our request for FRPP funds on the lesser amount of match funds available in the state. In fiscal year 2012, there will be $2.4 million in state funds available for match against FRPP under the current program. Therefore, we request that $4.8 million in FRPP funds be allocated to Virginia to fully match this portion of the state investment in land conservation. *(See Section IV for a breakdown of Virginia's FY 2012 request.)*

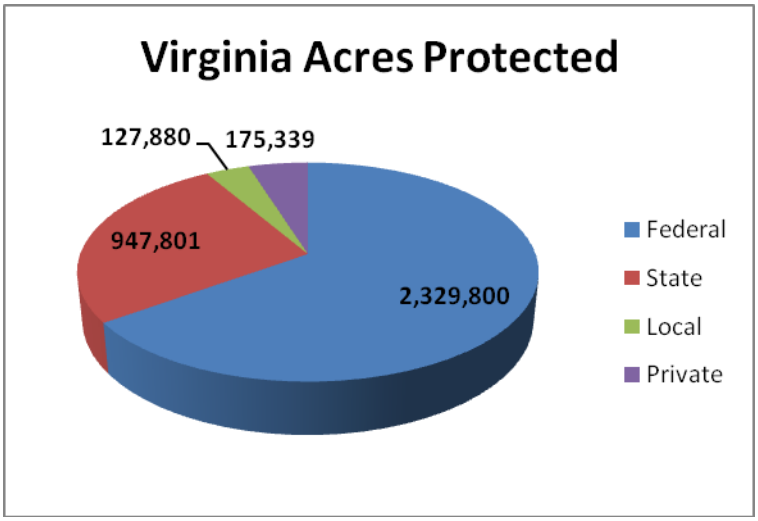

Figure 1

II. Virginia Land Conservation

The modern era of land conservation in Virginia began on June 13, 1968, when the first Virginia Outdoors Foundation (VOF) easement was recorded; it was on 102 acres in Goochland County, Virginia. VOF was created 32 years ago by the Virginia General Assembly "to preserve the natural, scenic, historic, scientific, open-space and recreational areas of the Commonwealth" amongst other land conservation related activities. Since then, VOF, a state supported foundation and the state of Virginia's largest land trust, has protected over 600,000 acres. Almost 450,000 of those acres have been preserved in the last decade. In that same decade, 707,041 acres were protected statewide, bringing the number of acres protected in Virginia to 3,580,820 (see Figure 1).

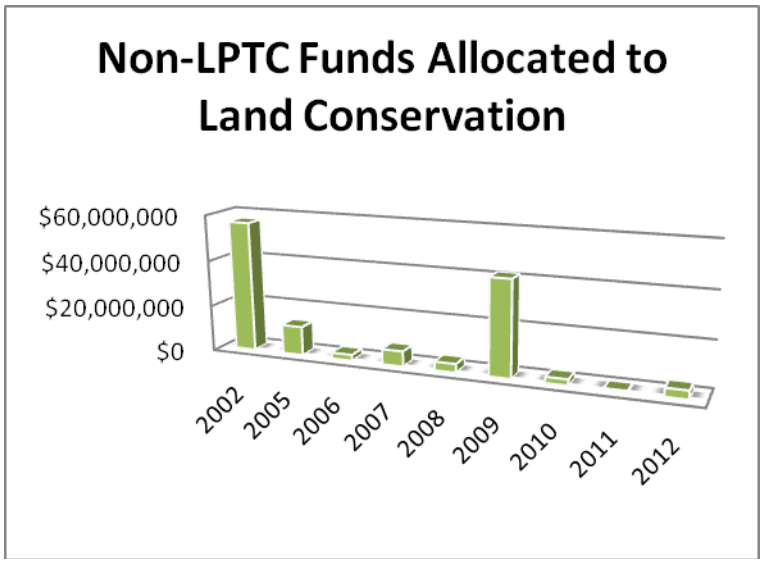

Figure 2

Both the current governor and his predecessor have made increased land conservation a priority of their administrations. With each of them announcing a goal of conserving 400,000 acres in Virginia during their 4-year terms, the Virginia land conservation community has been both inspired and challenged.

This support has not kept Virginia's direct expenditures for land conservation from fluctuating over the last decade (Figure 2). At $600,000, 2011 was the low point for direct funding levels. At the same time, indirect expenditures for land conservation through the Land Preservation Tax Credit (LPTC) have been increasing (Figure 3). Fortunately, the direct expenditures have seen a slight rebound for 2012.

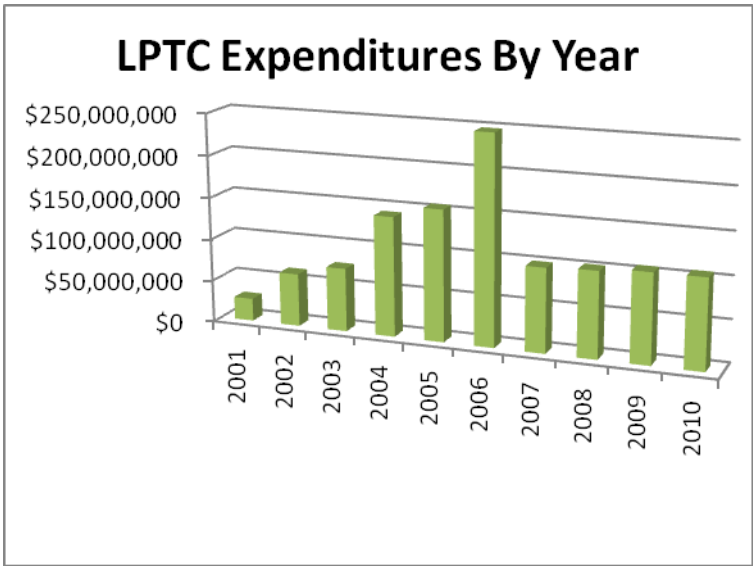

Figure 3

This unpredictable, and often limited, direct funding may be one reason so much of Virginia's land conservation in the last ten years has been accomplished through the LPTC. In fact, VOF, the state's largest and oldest land trust, relies almost entirely on the LPTC to drive its land

protection efforts. Their efforts account for 64% of the land protected in the state between 2001 and 2010.

An area where Virginia's land conservation effort is expanding through direct funding at the state and local level is the Purchase of Development Right's (PDR). There are 22 localities in the state with active PDR programs, many of them assisted in part by the Virginia Department of Agricultural and Consumer Service's Office of Farmland Preservation (VDACS). Several PDR programs have combined funds received from VDACS with FRPP funds to protect productive farmland in their localities. VDACS is expected to provide $1.2 million in grant funds to the PDR programs in the first quarter of 2012. These funds will be an excellent source of match for FRPP.

The other primary source of match funding in 2012 will come from the Virginia Land Conservation Foundation (VLCF), which has $2,437,465. According to VLCF staff, $448,047 is dedicated to the Farmland and Forest Preservation category and another $772,524 to the Open Space and Parks category, for a combined total of $1,220,571. The remaining funds could go to an FRPP eligible product, but the land would have to have conservation values in addition to those found in FRPP.

Virginia is also home to an award winning state park system that includes Chippokes Plantation State Park, one of the nation's oldest and continuously working farms. This is in addition to the extensive national parks and forests in the state.

III. Farm and Ranch Lands Protection Program Priority Areas

The FRPP state plan must include information on the degree of development pressure in the state. In addition, it must show priority areas that have the potential for sustainable agricultural activity and are threatened by development. To answer both of these requirements, we have prepared the map on page 6.

The map identifies the Prime Farmlands vulnerable to the threat of urban, suburban, and rural development. The map was derived by combining information from a Composite Vulnerability Model[1] published by the Virginia Department of Conservation and Recreation's Division of Natural Heritage (Appendix 1) and the Prime Farmland from the statewide Soil Survey Geographic (SSURGO) database.

As the purpose of the FRPP program is to "protect the agricultural use and related conservation values of eligible land by limiting nonagricultural uses of that land"[2], it is appropriate that the priority areas of FRPP be the areas where potential agricultural use is most threatened by nonagricultural uses. This intersection of development pressure and prime farmland is the area of priority for FRPP in Virginia.

IV. Justification of Funding Request

[1] Bulluck, J.F., J.M. Ciminelli, and J.T. Weber, 2007. Natural Landscape Assessment and Green Infrastructure – Completion and Distribution: Final Report. Natural Heritage Technical Report #07-17. Virginia Department of Conservation and Recreation, Division of Natural Heritage. Richmond, Virginia.

[2] 16 U.S.C. 3838i(b)

Based on information from state land conservation agencies, land trusts operating in the state, and local officials, the minimum amount of funding to match FRPP that will be available in federal fiscal year 2012 is $2,420,571. Funding scenario 5 from Figure 519-F2 on page 519-F6 of the FRPP policy manual, which allows for the maximum FRPP Share of 50% of fair market value, minimum entity contribution of 25% of the purchase price or entity basis, and a landowner donation of 25% of the fair market value, is the most common FRPP scenario in Virginia. Due to Virginia's substantial tax credit for land preservation, this scenario provides the greatest incentive to both the landowner and the entity to participate in FRPP. To utilize only the minimum available match funding in Virginia for fiscal year 2012 in scenarios like this, we require an allocation of $4,841,142.

2012 STATE FRPP PLAN Summary	
State: Virginia	
Topic	**Data**
Total FRPP Funds Requested for FY 2012 (Oct 2011 to Sept 2011)	$ 4,841,142.00
Total Acres to be Protected in Fiscal Year 2012 (in FRPP)	2,454
Acres of Prime, Unique, and Important Farmland Soil to be Protected in FY 2012 (in FRPP)	1,227
Information on Potential Cooperating Entities (complete information below for each entity expected to participate in FRPP in FY 2012)	
Non-FRPP Entity Farmland Protection Easement Cash Expenditures($) in the State in FY2011 (including land value, appraisal, survey, legal, closing, and monitoring costs, but excluding funds used for matching FRPP funds)	Dollars for Each Entity
Commonwealth of Virginia (Land Preservation Tax Credit)	$ 106,000,000.00
Virginia Land Conservation Foundation	$ 500,000.00
Virginia Office of Farmland Preservation	$ 100,000.00
Non-FRPP Farmland Protection Easement Donations of Land Value Received by the Entity in the State in FY2011 (excluding donations of land value used for matching FRPP funds)	Dollars for Each Entity
Based on meeting statewide cap on Virginia Land Preservation Tax Credit Cap in 2011	$ 265,000,000.00

FRPP STATE PLAN REQUIREMENTS		
Topic	Data	Source
1. Degree of development pressure, such as local rates of land conversion, as documented by population growth and density (U.S. Census) and farmland loss (Agricultural Census, National Agricultural Statistics Service)	See Appendix # 1	Bulluck, J.F., J.M. Ciminelli, and J.T. Weber, 2007. Natural Landscape Assessment and Green Infrastructure – Completion and Distribution: Final Report. Natural Heritage Technical Report #07-17. Virginia Department of Conservation and Recreation, Division of Natural Heritage. Richmond, Virginia.
2. Priority areas that have the potential for sustainable agricultural activity and are threatened by development	See Map # 1	428,341 acres of Prime Farmland under the greatest threat of development in Virginia.
3. Acreage of prime, unique, and statewide and locally important farmland lost (according to the two most recent reports of the National Resources Inventory)	43,200	2007 NATIONAL RESOURCES INVENTORY; Virginia; April 22, 2010; Table D. Prime farmland area in thousands of acres, by broad cover/use and year (2002 to 2007)
4. Acreage of total farmland lost (according to the two most recent reports of the National Resources Inventory)	240,300	2007 NATIONAL RESOURCES INVENTORY; Virginia; April 22, 2010; Table B-2. Changes in broad cover/use in thousands of acres between 2002 and 2007
5. Total acres proposed for protection for the duration of the plan	428,341	Acres within FRPP Priority Area
6. Acreage of total farmland estimated to be protected for the duration of the plan	428,431	Acres of farmland within FRPP Priority Area
7. Acreage of prime, unique, and statewide and locally important farmland estimated to be protected for the duration of the plan	428,431	Acres of Prime Farmland within FRPP Priority Area
8. Number or acreage of historic and archaeological sites estimated to be protected with FRPP funds on farm or ranch lands	NA	Data requested from Virgnia Department of Historic Resources
9. Average value of farmland in areas targeted in the plan	5,261	Average per acre price of lands in FRPP Priority Area
10. Estimated average FRPP contribution per acre of land targeted in the plan	$1,973	Estimated FRPP Contribution = (Average per acre price - Estimated Loss in FMV due to Easement of 75%) x (Maximum FRPP Contribution of 50%)
11. Amount of the average Federal share (dollars) to be contributed to the acquisition of the estimated acres needing to be protected	$845,063,250	(Estimated average FRPP contribution per acre of land targeted in the plan) x (Total acres proposed for protection for the duration of the plan)
12. Amount of FRPP dollars requested by fiscal year and for the duration of the plan	$4,841,142	Based on potential match of $2.4 M and Cost Share Formula for 2009 and Subsequent years
13. History of participating entities' experience in acquiring, managing, holding, and enforcing conservation easements, (including annual farm and ranch lands protection expenditures, monetary donations received, accomplishments, and staff)	See Appendix # 2	Information provided by participating entities in FRPP applications or published on their webpages.
14. History of participating entities' commitment to conservation planning and conservation practice implementation (requirements in State statute, local ordinances, or nongovernmental organization articles of incorporation and annual accomplishments)	See Appendix # 2	
15. History of an eligible entity's commitment to assisting beginning farmers and ranchers, to promoting opportunities for farming and ranching, and farm and ranch succession and transfer	See Appendix # 2	
16. Eligible entities' estimated unfunded portfolio: number and acreage of all parcels and acreage of prime, unique, and statewide and locally important soils	NA	Data requested from Virgnia Land Conservation Community
17. Ranking factors including weights and the quantitative scoring criteria for each factor	See Appendix # 3	

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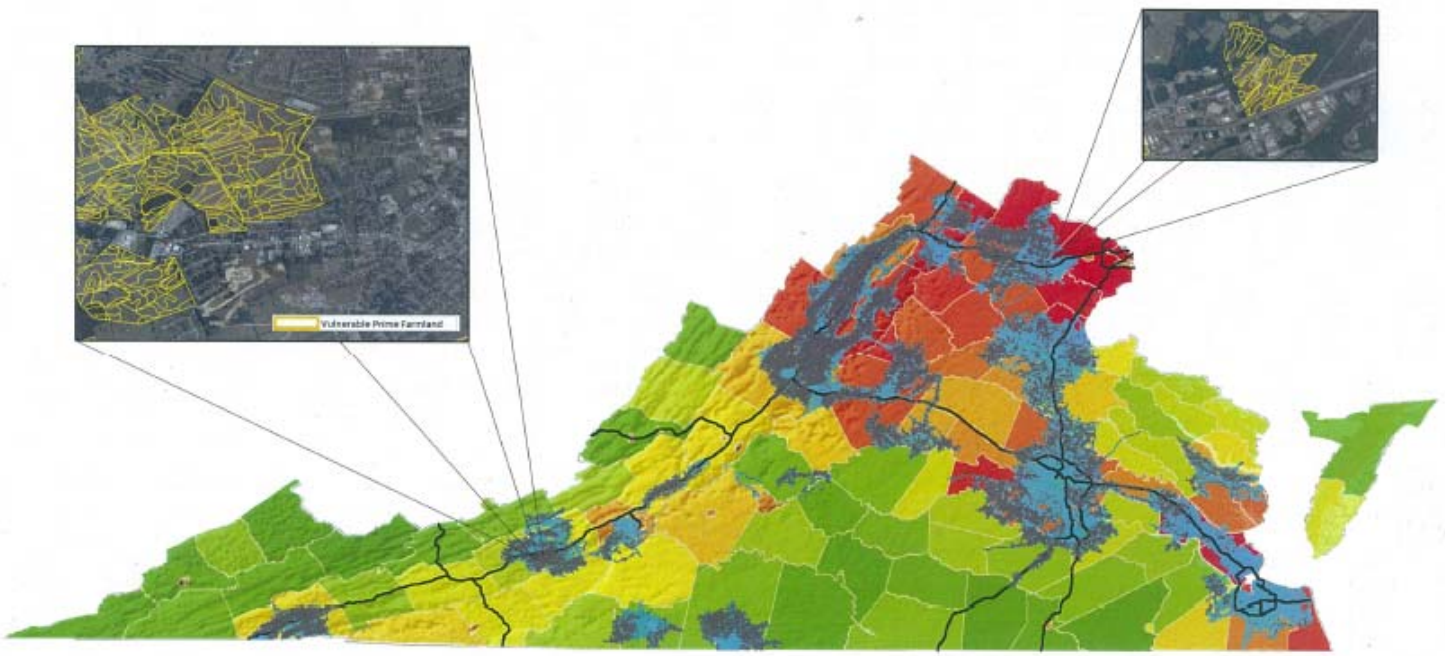
PRIME FARMLANDS VULNERABLE TO URBAN, SUBURBAN, AND RURAL DEVELOPMENT

FRPP PRIORITY AREAS



LEGEND
Vulnerable Prime Farmlands
DCR Vulnerability Threat Level 8 (Highest)
Virginia Interstate Highways
Ag Land, Inc Bldgs - Asset Value, Measured in $ / Acre By County
LOWEST
HIGHEST

Miles
0 20 40 80 120 160

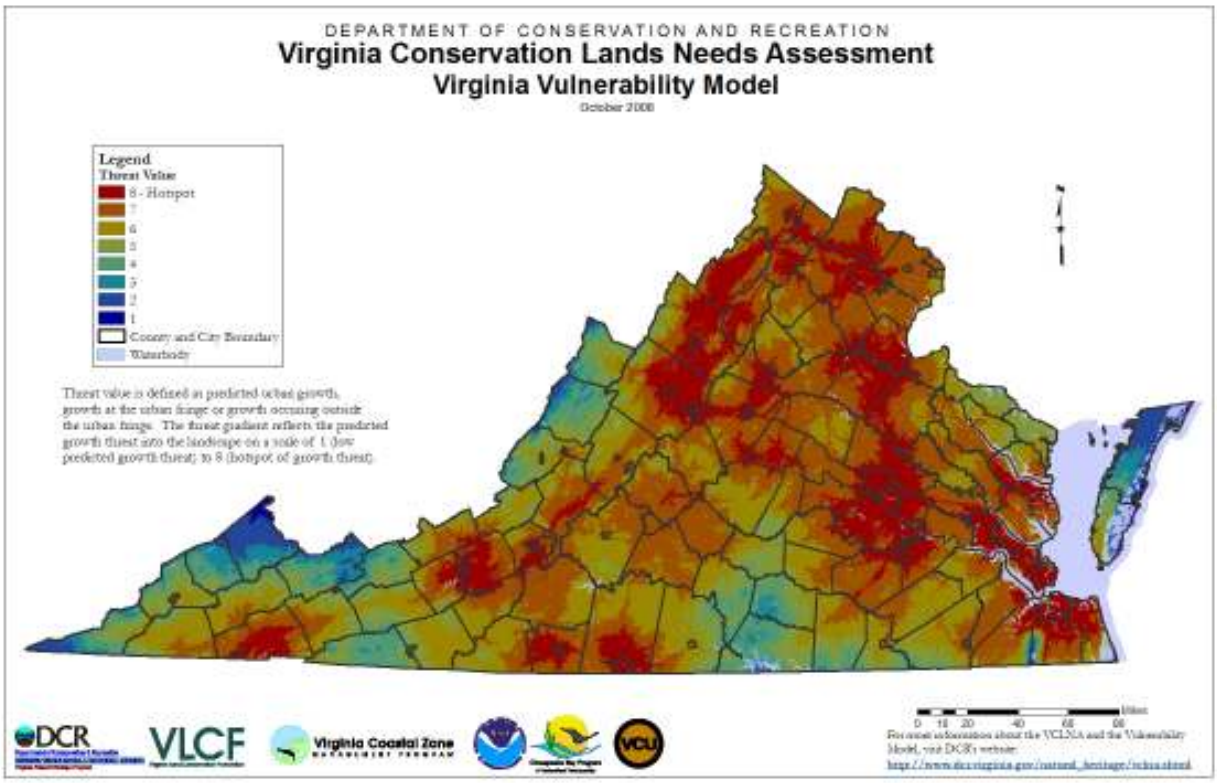
N
W E
S

Project Objective: To identify Prime Farmlands vulnerable to the threat of urban, suburban, and rural development. Exported the highest threat level (8) from a Composite Vulnerability Model produced by the Virginia Department of Conservation and Recreation (DCR) - Natural Heritage. "All areas are prime farmland" and "Farmland of statewide importance" were exported from a statewide SSURGO merge (5/2011). The SSURGO export, a statewide Common Land Unit (CLU) merge, and the level 8 threat were intersected to define the geographic "areas of concern for FRPP". To understand agricultural land values by Virginia County, The National Agricultural Statistics Service (NASS) Quick Stats was queried for "Ag. land asset values (including buildings) measured in $/acre by County." To derive an estimate of acres, "0" values were deleted from the CLUCLSCD column before calculating. A final intersect of the "areas of concern for FRPP" and "Ag. land asset values..." was used to derive mean property values within the areas of concern.

This map was produced at the Virginia State Office of the USDA Natural Resources Conservation Service in Richmond, VA
Updated 06/23/2011 (SEG)

Appendix # 1

Virginia Conservation Lands Needs Assessment
Virginia Vulnerability Model



Virginia Department of Conservation and Recreation Division of Natural Heritage
Virginia DEQ Coastal Zone Management Program

DCR
Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL & RECREATIONAL RESOURCES
Virginia Natural Heritage Program

Virginia Coastal Zone
MANAGEMENT PROGRAM

This work is funded by the Virginia Coastal Zone Management Program at DEQ through grant #NAO5NOS4191180 from the National Oceanic and Atmospheric Administration to the Virginia Department of Conservation and Recreation's Natural Heritage Program

TABLE OF CONTENTS

INTRODUCTION 1
Application of the Vulnerability Model 2
Deliverables 2
METHODOLOGY 3
Base Data 3
Livable area road density 6
Housing Allocation Procedure 6
Lot Size Estimation 7
Statistical Analyses 7
Growth Hot Spots 8
Threat Grids 10
Model Validation 12
Discussion 12
FUTURE APPLICATIONS 13
Additional Data Incorporation 13
REFERNCES 14
Table 1. List of cities and counties used in the final regression model. 15
Figure 1. PDC 1 LENOWISCO Vulnerability Model 16
Figure 2. PDC 1 LENOWISCO Urban Vulnerability Model. 17
Figure 3. PDC 1 LENOWISCO Urban Fringe Vulnerability Model. 18
Figure 4. PDC 1 LENOWISCO Outside the Urban Fringe Vulnerability Model. 19
Figure 5. PDC 2 Cumberland Plateau Vulnerability Model. 20
Figure 6. PDC 2 Cumberland Plateau Urban Vulnerability Model. 21
Figure 7. PDC 2 Cumberland Plateau Urban Fringe Vulnerability Model. 22
Figure 8. PDC 2 Cumberland Plateau Outside the Urban Fringe Vulnerability Model. 23
Figure 9. PDC 3 Mount Rogers Vulnerability Model 24
Figure 10. PDC 3 Mount Rogers Urban Vulnerability Model 25
Figure 11. PDC 3 Mount Rogers Urban Fringe Vulnerability Model 26
Figure 12. PDC 3 Mount Rogers Growth Outside the Urban Fringe Vulnerability Model . 27
Figure 14. PDC 4 New River Valley Urban Vulnerability Model 29
Figure 15. PDC 4 New River Valley Urban Fringe Vulnerability Model 30
Figure 16. PDC 4 New River Valley Growth Outside the Urban Fringe Vulnerability Model 31
Figure 17. PDC 5 Roanoke Valley-Alleghany Regional Commission Vulnerability Model. 32
Figure 18. PDC 5 Roanoke Valley-Alleghany Regional Commission Urban Vulnerability Model. 33
Figure 19. PDC 5 Roanoke Valley-Alleghany Regional Commission Urban Fringe Vulnerability Model. 34
Figure 20. PDC 5 Roanoke Valley-Alleghany Regional Commission Outside the Urban Fringe Vulnerability Model. 35
Figure 21. PDC 6 Central Shenandoah Vulnerability Model. 36
Figure 22. PDC 6 Central Shenandoah Urban Vulnerability Model. 38
Figure 23. PDC 6 Central Shenandoah Urban Fringe Vulnerability Model. 40
Figure 24. PDC 6 Central Shenandoah Outside the Urban Fringe Vulnerability Model. 42

Figure 25. PDC 7 Northern Shenandoah Valley Regional Commission Vulnerability Model 44
Figure 26. PDC 7 Northern Shenandoah Valley Regional Commission Urban Vulnerability Model. 45
Figure 27. PDC 7 Northern Shenandoah Valley Regional Commission Urban Fringe Vulnerability Model. 46
Figure 28. PDC 7 Northern Shenandoah Valley Regional Commission Outside the Urban Fringe Vulnerability Model. 47
Figure 29. PDC 8 Northern Virginia Regional Commission Vulnerability Model. 48
Figure 30. PDC 8 Northern Virginia Regional Commission Urban Vulnerability Model. ... 49
Figure 31. PDC 8 Northern Virginia Regional Commission Urban Fringe Vulnerability Model. 50
Figure 32. PDC 8 Northern Virginia Regional Commission Outside the Urban Fringe Vulnerability Model. 51
Figure 33. PDC 9 Rappahannock-Rapidan Regional Commission Vulnerability Model. 52
Figure 34. PDC 9 Rappahannock-Rapidan Regional Commission Urban Vulnerability Model. 53
Figure 35. PDC 9 Rappahannock-Rapidan Regional Commission Urban Fringe Vulnerability Model. 54
Figure 36. PDC 9 Rappahannock-Rapidan Regional Commission Outside the Urban Fringe Vulnerability Model. 55
Figure 37. PDC 10 Thomas Jefferson Planning District Commission Vulnerability Model. 56
Figure 38. PDC 10 Thomas Jefferson Planning District Commission Urban Vulnerability Model. 57
Figure 39. PDC 10 Thomas Jefferson Planning District Commission Urban Fringe Vulnerability Model. 58
Figure 40. PDC 10 Thomas Jefferson Planning District Commission Outside the Urban Fringe Vulnerability Model. 59
Figure 41. PDC 11 Region 2000 Local Government Council Vulnerability Model. 60
Figure 42. PDC 11 Region 2000 Local Government Council Urban Vulnerability Model. . 61
Figure 43. PDC 11 Region 2000 Local Government Council Urban Fringe Vulnerability Model. 62
Figure 44. PDC 11 Region 2000 Local Government Council Outside the Urban Fringe Vulnerability Model. 63
Figure 45. PDC 12 West Piedmont Planning District Commission Vulnerability Model. ... 64
Figure 46. PDC 12 West Piedmont Planning District Commission Urban Vulnerability Model. 65
Figure 47. PDC 12 West Piedmont Planning District Commission Urban Fringe Vulnerability Model. 66
Figure 48. PDC 12 West Piedmont Planning District Commission Outside the Urban Fringe Vulnerability Model. 67
Figure 49. PDC 13 Southside Planning District Commission Vulnerability Model. 68
Figure 50. PDC 13 Southside Planning District Commission Urban Vulnerability Model. . 69
Figure 51. PDC 13 Southside Planning District Commission Urban Fringe Vulnerability Model. 70
Figure 52. PDC 13 Southside Planning District Commission Outside the Urban Fringe Vulnerability Model. 71
Figure 53. PDC 14 Commonwealth Regional Council Vulnerability Model. 72

Figure 54. DC 14 Commonwealth Regional Council Urban Vulnerability Model. 73
Figure 55. PDC 14 Commonwealth Regional Council Urban Fringe Vulnerability Model.. 74
Figure 56. PDC 14 Commonwealth Regional Council Growth Outside the Urban Fringe Vulnerability Model. 75
Figure 57. PDC 15 Richmond Regional Vulnerability Model. 76
Figure 58. PDC 15 Richmond Regional Urban Vulnerability Model. 77
Figure 59. PDC 15 Richmond Regional Urban Fringe Vulnerability Model. 78
Figure 60. PDC 15 Richmond Regional Outside the Urban Fringe Vulnerability Model..... 79
Figure 61. PDC 16 George Washington Regional Commission Vulnerability Model. 80
Figure 62. PDC 16 George Washington Regional Commission Urban Vulnerability Model. 81
Figure 63. PDC 16 George Washington Regional Commission Urban Fringe Vulnerability Model. 82
Figure 64. PDC 16 George Washington Regional Commission Outside the Urban Fringe Vulnerability Model. 83
Figure 65. PDC 17 Northern Neck Vulnerability Model. 84
Figure 66. PDC 17 Northern Neck Urban Vulnerability Model 85
Figure 67. PDC 17 Northern Neck Urban Fringe Vulnerability Model. 86
Figure 68. PDC 17 Northern Neck Outside the Urban Fringe Vulnerability Model. 87
Figure 69. PDC 18 Middle Peninsula Vulnerability Model. 88
Figure 70. PDC 18 Middle Peninsula Urban Vulnerability Model 89
Figure 71. PDC 18 Middle Peninsula Urban Fringe Vulnerability Model. 90
Figure 72. PDC 18 Middle Peninsula Outside the Urban Fringe Vulnerability Model. 91
Figure 73. PDC 19 Crater Vulnerability Model. 92
Figure 74. PDC 19 Crater Urban Vulnerability Model. 93
Figure 75. PDC 19 Crater Urban Fringe Vulnerability Model. 94
Figure 76. PDC 19 Crater Outside the Urban Fringe Vulnerability Model. 95
Figure 77. PDC 22 Accomack-Northampton Planning District Commission Vulnerability Model. 96
Figure 78. PDC 22 Accomack-Northampton Planning District Commission Urban Vulnerability Model. 97
Figure 79. PDC 22 Accomack-Northampton Planning District Commission Urban Fringe Vulnerability Model. 98
Figure 80. PDC 22 Accomack-Northampton Planning District Commission Outside the Urban Fringe Vulnerability Model 99
Figure 81. PDC 23 Hampton Roads Planning District Commission Vulnerability Model. 100
Figure 82. PDC 23 Hampton Roads Planning District Commission Urban Vulnerability Model 101
Figure 83. PDC 23 Hampton Roads Planning District Commission Urban Fringe Vulnerability Model 102
Figure 84. PDC 23 Hampton Roads Planning District Commission Outside the Urban Fringe Vulnerability Model 103
Figure 85. Coastal Zone Vulnerability Model. 104
Figure 86. Coastal Zone Urban Vulnerability Model. 105
Figure 87. Coastal Zone Urban Fringe Vulnerability Model. 106
Figure 88. Coastal Zone Outside the Urban Fringe Vulnerability Model. 107
Figure 89. Virginia Vulnerability Model. 108
Figure 90. Virginia Urban Vulnerability Model. 109

Figure 91. Virginia Urban Fringe Vulnerability Model. 110
Figure 92. Virginia Outside the Urban Fringe Vulnerability Model. 111

INTRODUCTION

The Virginia Vulnerability Model was developed in an effort to map predicted growth in Virginia. The growth prediction may be used as an indication of potential land use change from the current use to an urban or suburban use.

In an effort to map the predicted growth in Virginia, four models were developed:

- Virginia Urban Vulnerability Model which shows predicted urban growth
- Virginia Urban Fringe Vulnerability Model which shows the predicted urban fringe, or metropolitan fringe growth.
- Virginia Vulnerability beyond the Urban Fringe Model which show the predicted growth beyond the urban fringe (ex-urban growth).
- Virginia Vulnerability Model which shows a composite of all the vulnerability models integrated into one model representing growth pressures across the urban, suburban and rural landscape.

(E. H. Wilson et al. 2003, R. E. Heimlich and W. D. Anderson, 2001)

The Vulnerability models represent predicted urban growth into the landscape and it is incumbent on the end user to assess what growth represents in terms of sprawl (E. H. Wilson et al. 2003). Urban growth that continues in an unplanned fashion, particularly into previously undeveloped areas, typically has a negative effect on the environment, ecologically, economically and socially (E. H. Wilson et al. 2003, R. E. Heimlich and W. D. Anderson, 2001). As growth and subsequent development continues across the state, remaining resources are being damaged and irretrievably lost.

The development of a GIS vulnerability model puts growth into context in relation to the state; it provides a large scale picture of growth patterns across jurisdictional boundaries. Traditionally state and local government has been reactive to population growth, and while some efforts are being made to control growth, often "strategically directing development to the most favorable areas well in advance of urban pressures" does not happen (R. E. Heimlich and W. D. Anderson, 2001).

The models, detailed above, represent different growth effects. The only model showing all predicted growth effects is the Virginia Vulnerability Model. The Urban Vulnerability Model shows the predicted urban growth into the landscape, it does not include the suburban or rural growth pressures. The Urban Fringe Vulnerability Model shows the predicted urban fringe, also typically called suburban, growth into the landscape, it does not include urban or rural growth pressures. The Beyond the Urban Fringe Vulnerability Model shows predicted growth outside of the urban fringe, or rural growth pressures, it does not include urban or suburban growth pressures.

The Vulnerability model may serve as a guide to state and local government, consultants, and developers as to the location of growth patterns, particularly in relation to the current environment. The model can be used alone or integrated with other datasets, such as the VCLNA Cultural Model or Ecological Model, to identify which cultural resources or ecological cores are most at risk to these growth pressures. The model may also be used to help guide local land use planners in the development of their comprehensive plans in an effort to control growth and subsequent development within their jurisdiction. It is important to look at the landscape as a whole and assess how growth may impact the environment, what remaining farmland or timberland is available or how water quality will be affected, before more development is introduced.

The models serve as part of a larger green infrastructure plan, which aims to model where Virginia's conservation priorities are located to facilitate an integrated approach to planning and development. For information on the Virginia Conservation Lands Needs Assessment and the Green Infrastructure Modeling effort, please visit the VCLNA website at http://www.dcr.virginia.gov/dnh/vclna.htm.

Application of the Vulnerability Model

Some general categories of uses to which the vulnerability model can be applied include:

- Targeting – to identify targets for protection activities
- Prioritizing – to provide primary or additional justification for key conservation land purchases and other protection activities.
- Local planning – guidance for comprehensive planning and local ordinance and zoning development.
- Assessment – to review the state of the land and assess growth in context of the landscape
- Land Management – to guide property owners and public and private land managers in making land management decisions that enhance ecological, social and economic services
- Public Education – to inform the citizenry about the development and growth of their community, helping them stay informed about the state of growth of their area.

The Vulnerability Model serves as a base model, upon which local datasets can be added, such as zoning information, comprehensive plans, parcel data, septic suitability information and any other datasets which may help drive local decision making processes. The constraints of a statewide model include the incorporation of existing, statewide GIS datasets. Incorporation of datasets such as individual locality septic sewer information may not be available statewide and are not included in the model since the effect would skew overall model results. Individuals should use the Vulnerability Models and incorporate any additional datasets as needed to make informed decisions. It is at this local level the end user may be able to draw his / her own conclusions on growth, sprawl and the impending consequences.

Deliverables

Maps will be produced for the entire Coastal Zone and the Planning District Commissions and included as part of the final report. The report will be available online and on CD by request and include:

- Maps showing:
    - Virginia Urban Vulnerability Model
    - Virginia Urban Fringe Vulnerability Model
    - Virginia Vulnerability outside the Urban Fringe Model
    - Virginia Vulnerability Model which shows a composite of all the vulnerability models integrated into one model representing growth pressures across the urban, suburban and rural landscape.
- A report detailing the methodology
- Metadata
- Four (4) GRID coverages representing the above detailed models.
- Four (4) shapefiles representing the above detailed models.
- An ArcGIS geodatabase with threat feature classes.

METHODOLOGY

Data methods were based on the Chesapeake Bay Program's Vulnerability Model. The methodology has been modified in some places and changed in others to reflect Virginia specific needs. Please refer to the Chesapeake Bay Program's Resource Lands Assessment for a review of the CPB RLA Vulnerability Model methodology (http://www.chesapeakebay.net/rla.htm).

Base Data

LAYER	DESCRIPTION	SOURCE
rd3_33x33_0	Road density grid	• Tiger Roads (2000)
slope_pct22	Grid representing slope greater than or less than and equal to 22 %	• National Elevation Dataset
blkgrp_90	1990 Census block group boundaries with associated summary file information	• Geography Network (polygon shapefile) • American Fact Finder (SF tables)
blkgrp_00	2000 Census block group boundaries with associated summary file information	• Geography Network (polygon shapefile) • American Fact Finder (SF tables)
zero_blks	2000 Census block group grid that has 0 population and 0 housing units	• blkgrp_00
wwte	Grid representing livable area	• RESAC 2000
exlands_2	Road density in livable area	• rd3_33x33_0 • slope_pct22 • zero_00blks • wwte
rddent_90	Census block group road density	• blkgrp_90 • rd3_33x33_0
rddent_00	Census block group road density	• blkgrp_00 • rd3_33x33_0
rdalloc_90	Relative percentage of road density per census block group pixel	• exlands_2 • rddent_90
rdalloc_00	Relative percentage of road density per census block group pixel	• exlands_2 • rddent_00
shu_90	Housing unit block group grid	• blkgrp_90
shu_00	Housing unit block group grid	• blkgrp_00
shu_90pix	Single family detached housing units per pixel grid	• shu_90
shu_00pix	Single family detached housing units per pixel grid	• shu_00
regnet	1 square mile grid	• Generated in ArcINFO
vaimp90	1990 Impervious surface image of the Chesapeake Bay portion of VA	• Chesapeake Bay Program- RESAC
vaimp00	2000 Impervious surface image of the Chesapeake Bay portion of VA	• Chesapeake Bay Program- RESAC
diffimp90_00	Change in impervious surface from 1990 to 2000	• vaimp90 • vaimp00
f_diffimp	Filtered change in impervious surface.	• diffimp90_00

imp90_00_2	Grid where pixel value is considered to be at least 20%.	• f_diffimp
hspots_imp	Impervious hotspot	• regnet
urban core	Urban areas	• regnet • RUCA table • 2000 census block group
urban commute	Suburban areas / urban fringe area	• regnet • RUCA table • 2000 census block group
rural	Area outside the urban fringe	• regnet • RUCA table • 2000 census block group
hspots_core	Urban hotspots	• regnet
hspots_urbcomm	Urban fringe hotspots	• regnet
hspots_rural	Hotspots outside the urban fringe	• regnet
hspots_1	Combined impervious and urban hotspots	• hspots_imp • hspots_core
hspots_2	Combined impervious and urban fringe hotspots	• hspots_imp • hspots_commute
hspots_3	Combined impervious and rural hotspots	• hspots_imp • hspots_rural
rds_ttime2	Travel time grid	• Tiger Roads (2000)
➢ **threat_1** ➢ **thrt_urb**	Urban growth prediction grid	• hspots_1 • rds_ttime2
➢ **threat_2** ➢ **thrt_urbfrg**	Urban fringe growth prediction grid	• hspots_2 • rds_ttime2
➢ **threat_3** ➢ **thrt_ourbfrg**	Prediction grid for growth outside the urban fringe.	• hspots_3 • rds_ttime2
threat1_x33	Proportional urban growth prediction grid	• threat_1
threat2_x33	Proportional urban fringe growth prediction grid.	• threat_2
threat3_x33	Proportional growth prediction grid for growth outside the urban fringe.	• threat_3
threat1_x33_0	Proportional urban growth prediction grid with NODATA values set to 0.	• threat1_x33
threat2_x33_0	Proportional urban fringe growth prediction grid with NODATA values set to 0.	• threat2_x33
threat3_x33_0	Proportional growth prediction grid for growth outside the urban fringe with NODATA values set to 0.	• threat3_x33
threat_sum	Integrated growth prediction grid.	• threat1_x33_0 • threat2_x33_0 • threat3_x33_0

Projection

Lambert Conformal Conic

NAD 83

Meters

Virginia Grid

- Set snap environment to RESAC
- Generated a 1 square mile grid for the state using the GENERATE and FISHNET commands in ArcINFO.
- Exported to a feature class called REGNET

Slope

In GRID:

- Generated slope from the NED dataset
- Selected slope > 22% = 0, other 1

```
Grid: |> setwindow resac resac <|
Grid: |> setcell resac <|
Grid: |> slope_pct22 = con(slope > 22, 0, 1) <|
```

Roads

- Downloaded TIGER roads
- Calculated a road density grid in a 1km area

```
Grid: |> rd_33x33 = focalsum ((roads), rectangle, 33, 33, data) <|
Running... Value range for c:\projects\rla\vulnerability\data\tiger_rds\rd_33x33 exceeds 100000
and number of unique values exceeds 500.
Please use BUILDVAT if a VAT is required.
Grid: |> buildvat <|
Usage:  BUILDVAT <grid>
Grid: |> buildvat rd_33x33 <|
Grid: |> q <|
```

Census Data

- Downloaded census block group data from ESRI Geography Network (http://arcdata.esri.com/data/tiger2000/tiger_statelayer.cfm).
- Downloaded 2000 Census tabular data from American Fact Finder.
- Downloaded 1990 Census block group tabular data from the SF3A Census Bureau CD.

1990 Block Group	***ATTRIBUTE***
Total Population	P0010001
Total Housing Units (100% count)	H0020001
1-unit, detached housing units (100%)	H0200001

2000 Block Group	***ATTRIBUTE***
Total Population	P001001
Total Housing Units (100%)	H003001
1-unit, detached housing units (100%)	H030002

zero_00blks

- In ArcMap, calculated Block Group 00 poly where total population = 0 and where housing units = 0. Coded the zero_blk as = 0. Reversed selection and calculated zero_blk = 1. Converted to a 30 meter grid.

Livable area road density

- Generate a grid (wwte) where livable areas are classed with a value = 1 and non-livable are classed = 0. Non-livable areas are set as open water, emergent wetlands, transportation and extractive. Used the VA LULC 2003 generated from RESAC and edited in house by Joe Weber.
- Generate a grid (ex_lands2) showing livable area road density values.

  Grid: |> ex_lands2 = rd3_33x33_0 * slope_pct22 * zero_00blks2 * wwte <|

Housing Allocation Procedure

Estimating the total number of single family housing units per pixel

1. Summarize livable area road density grid by unique block group for 1990 and 2000 census block groups.
2. Add a field to blkgrp_90 called rddent_90 and to blkgrp_00 called rddent_00. Calculate the SUM from the summarize into the rddent_tot field.
3. Convert blkgrp_90 to a grid.

   rddent_90 grid
   Field: rddent_tot
   Output cell size: 30 meter
   Output raster: rddent_90

   rddent_00 grid
   Field: rddent_tot
   Output cell size: 30 meter
   Output raster: rddent_00
4. Calculate relative percentage of blk grp road density per pixel.

   Arc: |> grid <|
   Grid: |> setwindow ex_lands2 ex_lands2 <|
   Grid: |> setcell ex_lands2 <|
   Grid: |> rdalloc_90 = (ex_lands2 * 1000000) / rddent_90 <|
   Running... Grid: |> setwindow ex_lands2 ex_lands2 <|
   Grid: |> setcell ex_lands2 <|
   Grid: |> rdalloc_00 = (ex_lands2 * 1000000) / rddent_00 <|
   Running... Grid: |> q <|
5. Convert blkgrps to grids. Set ex_lands2 as snap environment in ArcMap.

   Field: H0200001
   Output cell size: 30 meter
   Output raster: shu_90
   and
   Field: H030002
   Output cell size: 30 meter
   Output raster: shu_00
6. Create single family detached housing units per pixel grid (grid representing proportional # of housing units per pixel).

   Arc: |> grid <|
   Grid: |> setwindow ex_lands2 ex_lands2 <|
   Grid: |> setcell ex_lands2 <|
   Grid: |> shu_90pix = (rdalloc_90 / 1000000) * shu_90 <|
   Running...
   Grid: |> setwindow ex_lands2 ex_lands2 <|

Grid: |> setcell ex_lands2 <|
Grid: |> shu_00pix = (rdalloc_00 / 1000000) * shu_00 <|
Running...

Lot Size Estimation

Development of a regression model to predict lot size from road density values in order to determine land consumption rates.

1. Gather parcel data from select counties (including rural, suburban and urban counties) including zoning information.
2. Parcels not zoned residential as determined by the Municode or Zoning Ordinance deleted. Parcels zoned residential:
    - Attributed with a GIS_Acreage field (double)
    - Acreage calculated
    - Reprojected to Lambert NAD 83
    - Converted to centroid
    - Merged into one feature class
    - In ArcMap, run a spatial join to with REGNET and parcel centroids. Unique ID is REGNET_ID.
3. Set 0 values in the ex_lands2 grid to NO DATA for averaging purposes. Called exld_null.

    Grid: |> exld_null = setnull (ex_lands2 == 0, ex_lands2) <|
4. Use Zonal Statistics to Summarize exld_null in ArcMap (this is the average road density per unique REGNET grid cell).
    - Set snap environment to RESAC
    - Zone dataset: REGNET3
    - Zone field: REGNET_ID
    - Value: exld_null
    - Ignore NoData in calculations
    - Join table
    - Calculate MEAN road density into RDD_exnull attribute in REGNET.
5. Select REGNET where rdd_exldnull > 0 and export as REGNET2.
6. Select from REGNET2 cells that are completely within the Virginia state boundary. This is to remove any fragment areas. Called grid REGENT3.
7. In Access, create queries to calculate the average GIS acreage for each unique REGNET_ID.

Statistical Analyses

Statistical analyses were performed in SAS System 9.1. The full dataset included a total of 35 cities and counties from whom parcel information was obtained (see Table 1). Data for GIS Acreage less than 11 acres was subset for the regression analysis. The acreage was subset at 11 acres to establish a group of data with which to test full and submodels. Acreage above 11 acres was highly variable in the datasets indicating a potential lack of relationship between road density and parcel size.

Univariate statistics were run to test for data normality. Tests on the full dataset indicated non-normal data. The GIS Acreage was transformed with a natural log transformation. Univariate statistics and residual plots indicated data were normal. Transformed data residuals indicated the transformation captured the structure of the data.

8. In SAS System 9.x ran Univariate statistics and plotted residuals to test for normalcy. Transformed the average road density data with a natural log transformation. Tested again for normalcy. Ran regression analyses (PROC REG) to derive regression equation:

LNMeanLotSize = 1.8497 – (0.0128 * [rdd_exld]) + (0.00001154 * ([rdd_exld] * [rdd_exld]))

r-sq = .5365

p < .0001

This regression is applicable for lot sizes up to mean 10 acres as the regression data went up to 10 acre lot sizes total.

Growth Hot Spots

Identifying areas considered to be hot spots for population growth.

1. Add attributes to REGNET3 (double):
    - SHU_90
    - SHU_00
    - SHU90_00
    - CNVRT90_00
    - IMP90_00
2. Summarize shu_90pix and shu_00 pix by REGNET_ID:
    - Set snap environment to RESAC
    - Zone dataset REGNET3
    - Zone field REGNET_ID
    - Value raster shu_90pix and shu_00pix
    - Ignore NoData in calculations
    - Join table
    - Calculate SUM into shu_00 and shu_90 attributes in REGNET.
3. Calculate the change in housing units shu_00 – shu_90 = shu90_00
4. Add a field called MeanLotSize (double). Calculate the natural log and subsequent average lot size using the regression formula:

LNMeanLotSize = 1.8497 – (0.0128 * [rdd_exld]) + (0.00001154 * ([rdd_exld] * [rdd_exld]))

r-square = 0.5365

p-value < .0001

5. Calculate the change in land consumption rate:

CNVRT90_00 = shu90_00 * MeanLotSize

6. In ArcMap, Spatial Analyst, calculated the change in impervious surfaces from 1990 to 2000:
    - Set snap environment to RESAC
    - Raster calculator:
        - diffimp00_90 = [vaimp00_lam83 – vaimp90_lam83]
    - Ran a filter on the difference in impervious surface grid to smooth the data. Ran a 3 x 3 filter because larger filters were altering the data too much. I checked a 9 x 9 filtered grid against the 2000 RESAC data and saw many areas classed as having a large change in impervious in the diffimp grid, when RESAC was not classed as impervious. I felt the 9 x 9 filter misrepresented impervious surface change.

```
Grid: |> setwindow resac <|
Grid: |> setwindow resac resac <|
Grid: |> f_diffimp = focalmean (diffimp00_90, rectangle, 3, 3, data) <|
```

    - Select pixels where change in value is considered to be at least 20%:

```
Grid: |> setwindow resac resac <|
Grid: |> setcell resac <|
Grid: |> imp20_100_2 = select(F_DIFFIMP, 'value > 19') <|
```

7. Summarize change in impervious by REGNET_ID:
    - Set snap environment to RESAC
    - Zone dataset REGNET3

- Zone field REGNET_ID
- Value raster imp20_100_2
- Ignore NoData in calculations
- Join table
- Calculate MEAN into imp90_00_2 attribute in REGNET.

Impervious Hot Spots

Identifying areas considered to represent significant impervious growth.

8. Add a field to REGNET attribute table called LNIMP90_00_2 (double). Take the Log of imp90_00_2 (to normalize the data) and calculate into LNIMP90_00_2.
9. Ran PROC MEANS on LNIMP90_00_2 where values > 0 (alpha = .10, Standard Error = 1.64) (because this is an upper one tail test, so p value = .05). Use the Upper CL to select out impervious hotspots. Upper CL = 3.335.
10. Exported REGNET cells considered to be impervious hot spots:
    - Select by Attribute
    - Where
    - LNimp90_00_2 >= 3.335
    - Export as hspotsimp

Residential Land Conversion Hot Spots

Identifying areas considered to represent significant changes in residential land conversion / land consumption.

11. Downloaded RUCA codes from http://www.ers.usda.gov/briefing/rural/data/ruca/rucc.htm
12. Reclassify tracts per RLA:

Grow Zone	Reclassified category	Original RUCA
"1"	Urban Core Zone =	Metropolitan-area cores (1.0, 1.1)
"2"	Urban Commuting Zone =	Metropolitan-area high commuting (2.x), Metropolitan-area low commuting (3.x), and all secondary flows to Urban Areas (ranging from 5 – 50%).
"3" or "4"	Rural Zone =	All other areas (encompassing Large town, Small town, and Rural areas lacking secondary flow to Urban Areas).

13. Select all RUCA polygons where grow zone = 1 and acres > 50. Select from REGNET all polygons that have their center in the selected RUCA polygons. Export as Urban_Core.
14. Select all RUCA polygons where grow zone = 2 and acres > 50. Select from REGNET all polygons that have their center in the selected RUCA polygons. Export as Urban_Commute.
15. Select all RUCA polygons where grow zone = 3 and acres > 50. Select from REGNET all polygons that have their center in the selected RUCA polygons. Export as Rural.
16. Add an attribute to REGNET called LogCNVRT90_00. Select by attribute from REGNET where CNVRT90_00 > 0. Calculate the log: LogCNVRT90_00 = log (CNVRT90_00 + .0001).
17. In SAS, run PROC UNIVARIATE / CLM / PROC MEAN to calculate the significant STD on each rural, urban and urban commute attribute table at p < .05, SE = 1.64. This provides the statistically significant values are related to the upper and lower limits:

SE = (upper CL – Mean) / STD

18. Use calculated Upper CL from SAS PROC MEANS (alpha = .10, upper one tail test p<.05, SE = 1.64) to select out from Urban_Core, Urban_Commute and Rural where LogCNVRT90_00 = Upper CL:
    - Select by Attribute from Urban_Core where LogCNVRT90_00 >= 2.6343854. Export as hspots_core.
    - Select by Attribute from Urban_Commute where LogCNVRT90_00 >= 1.677184. Export as hspots_commute.
    - Select by Attribute from Rural where LogCNVRT90_00 >= 1.0177744. Export as hspots_rural.
17. Merge impervious surface hotspots and urban hotspots to create hotspots_1. Ran a UNION in ArcToolbox - hspots_imp + hspots_core = hspots_1.
18. Merge impervious surface hotspots and urban commute hotspots to create hspots_2. Ran a UNION in ArcToolbox - hspots_imp + hspots_commute = hspots_2.
19. Merge impervious surface hotspots and rural hotspots to create hotspots_3. Ran a UNION in ArcToolbox - hspots_imp + hspots_rural = hspots_3.
20. Converted each feature class to a grid:
    a. In ArcMap, calculated ID_1 = 1. Set snap environment to RESAC. Convert to a grid:

       Field: ID_1
       Output cell size: 30 meter
       Output raster: hspots_1, hspots_2, hspots_3

Threat Grids

Travel Time

Creating a travel time grid to incorporate the influence of distance to hot spots on surrounding areas.

1. Download Tiger Roads data. Added an attribute called RDS_TTIME (Long Integer). Calculated travel time based on CFCC codes and RLA methodology:

CFCC	Description	MPH	TTIME (minutes per meter * 100K)
A1	Primary highway with limited access (e.g., Interstates)	65	57
A2	Primary road without limited access (mainly US Highways)	55	68
A3	Secondary and connecting roads (e.g., State and County highways)	40	93
A4	Local, neighborhood, and rural roads	30	124
A6	Road with special characteristics (ramps, traffic circles, etc.)	15	249
Other	A5x's and A7x's (off-road trails, driveways, alleys, etc.)	5	746

65 * 1.60934 = 104.6 kph * 1000/60 = 1743 meters per minute, 1/1743 = 0.000574 minutes per meter

2. Convert tiger roads to a grid in ArcMap (Spatial Analyst → Features to Raster):

   Field: rds_ttime
   Output cell size: 30 meter
   Output raster: RDS_TTIME2
3. Change NoData values in TTIME to 746 (consider off road travel per RLA):

   Grid: |> setwindow resac <|
   Grid: |> setwindow resac resac <|
   Grid: |> rds_ttime2 = con (isnull (rds_ttime), 746, rds_ttime2) <|
4. Calculate the urban growth treat grid based on travel time to nearest hot spot:

   Grid: |> setwindow resac resac <|
   Grid: |> setcell resac <|
   Grid: |> threat_1 = int(costdistance(hspots_1, rds_ttime2)) <|
5. Calculate urban fringe / metropolitan fringe growth threat based on travel time:

   Grid: |> setwindow resac resac <|
   Grid: |> setcell resac <|

Grid: |> threat_2 = int(costdistance(hspots_2, rds_ttime2)) <|

6. Calculate outside the urban fringe growth threat based on travel time:

Grid: |> setwindow resac resac <|
Grid: |> setcell resac <|
Grid: |> threat_3 = int(costdistance(hspots_3, rds_ttime2)) <|

Threat

1. Multiply each grid by .33 to get a proportional value of threat / travel time in order to generate a summed threat grid of all three layers:

Grid: |> threat1_x33 = threat_1 * .33 <|
Grid: |> threat2_x33 = threat_2 * .33 <|
Grid: |> threat3_x33 = threat_3 * .33 <|

2. Set NODATA values to 0 to sum layers:

Grid: |> threat1_x33_0 = con(isnull(threat1_x33), 0, threat1_x33) <|
Grid: |> threat2_x33_0 = con(isnull(threat2_x33), 0, threat2_x33) <|
Grid: |> threat3_x33_0 = con(isnull(threat3_x33), 0, threat3_x33) <|

3. Sum threat layers together to generate a threat_sum grid showing an integrated threat grid:

Grid: |> setwindow resac resac <|
Grid: |> setcell resac <|
Grid: |> threat_sum = sum(threat1_x33_0, threat2_x33_0, threat3_x33_0) <|

4. Display threat_1 (urban growth threat), threat_2 (urban fringe growth) and urban_3 (outside the urban fringe growth) with 5 manual breaks in ArcMap, with a higher threat value indicates a great threat:

THREAT	GRID VALUE	TRAVEL TIME (minutes)
5	0	0
4	0.001 - 1,500,000	0 to 15
3	1,500,000.001 - 3,000,000	15 to 30
2	3,000,000.001 - 6,000,000	30 to 60
1	6,000,000.001 - 12,000,000	60 to 120

5. Display threat_sum (compiled threat model showing predicted growth in the urban, urban fringe and outside the urban fringe areas with 8 manual breaks in ArcMap (higher threat value indicates a greater growth threat):

THREAT	GRID VALUE	TRAVEL TIME (approx minutes)
8	0 – 1,000,000	0 to 10
7	> 1,000,000 – 2,000,000	10 to 20
6	> 2,000,000 – 3,000,000	20 to 30
5	> 3,000,000 – 4,000,000	30 to 40
4	> 4,000,000 – 5,000,000	40 to 50
3	> 5,000,000 – 6,000,000	50 to 60
2	> 6,000,000 – 9,000,000	60 to 90
1	> 9,000,000	> 90

The gradient is spread at smaller increments on the threat_sum grid because it proportionally reduced the original number to add into the final grid. .

6. Set threat grid values to numbers based on threat defined above in GRID.

For threat_1, threat_2 and threat_3 grids:

Grid: |> threat1_xx = con(threat_xx = = 0, 5, con(threat_xx > 0, con(threat_xx < = 1500000, 4, con(threat_xx > 1500000, con (threat_xx < = 3000000, 3, con(threat_xx > 3000000, con(threat_xx < = 6000000, 2, 1))))))) <|

For threat_all:

thrt_all= con(thrtall_va <= 1000000, 8, con(thrtall_va > 1000000, con(thrtall_va <= 2000000, 7, con(thrtall_va > 2000000, con(thrtall_va <= 3000000, 6, con(thrtall_va > 3000000, con(thrtall_va <= 4000000, 5, con(thrtall_va > 4000000, con(thrtall_va <= 5000000, 4, con(thrtall_va > 5000000, con(thrtall_va <= 6000000, 3, con(thrtall_va > 6000000, con(thrtall_va <= 9000000, 2, 1)))))))))) <|

7. Convert grids to a shapefile.
8. Generate metadata in ArcCatalog.
9. Convert shapefile to geodatabase feature classes.
10. Topology:
    a. Created a topology for UrbanGrowthThreat, UrbanFringeGrowthThreat, GrowthOutsidetheUrbanFringeThreat and VulnerabilityModel_AllThreat feature classes for the following rules:
        i. Must Not Overlap
        ii. Must Not Have Gaps
    b. Validated topology and cleaned where necessary.

Model Validation

The original version of the Vulnerability Model was sent to:

- Crater PDC
- Hampton Roads PDC
- Goochland County
- Middle Peninsula PDC
- Northern Neck PDC
- Thomas Jefferson PDC

Comments indicated the model was representing too much land as being hotspots or heavily weighted to indicate potential growth.

The model was re-run with statistical analyses to pick out values representing statistically significant hotspot values. Four models were developed instead of one overall vulnerability model to account for urban, suburban and rural growth pressures as individual issues, instead of compiling into one overall model. The data was becoming lost in over-generalization of values in order to develop a single model.

The final model was passed through an internal review at the Division of Natural Heritage.

The revised Vulnerability model was validated in house. Comments from the version 1 validation were applied to the model.

The VCLNA website will be equipped to receive comments regarding the Vulnerability model results. These comments will be reviewed and assessed in relation to the model; this will enable a continuing evaluation of the model. The Vulnerability Models represent prediction models, ground truthing hotspots at this point in time may not prove ineffective as the model projects out ten + years in time.

Discussion

The Vulnerability Model naming convention reflects U.S. Census designations and can be translated as the following:

- Urban Growth Prediction – Shows predicted urban growth patterns in Virginia.
- Urban Fringe Growth Prediction – Shows predicted suburban growth patters in Virginia. Suburban growth is defined as growth occurring in suburban designated areas. These areas are typically at the fringe or edge of urban growth and represent less dense growth than found in traditional urban settings.

- Growth Outside the Urban Fringe – Shows predicted rural growth patterns in Virginia. Rural growth is defined as growth in rural designated areas (i.e. larger lot size).

Model 2 Refinements

This version of the Vulnerability Model used more parcel data in the development of the regression model. The model was refined for a closer fit to the structure of the data. This can be seen in the hotspot analysis. The previous version of the model had hotspots located across Virginia, without a great deal of structure, reflecting noise in the data and potential over-representation of hotspots. Refinement of the SAS methodology allowed for tighter clusters of hotspots, reflecting a more accurate portrayal of landscape growth patterns. This can be seen in the number of hotspots identified during the two analyses:

Layer	***Version 1 Count***	***Version 2 Count***
hotspots 1	6135	2797
hotspots 2	11681	8916
hotspots 3	12798	9673

FUTURE APPLICATIONS

Additional Data Incorporation

Development of a statewide model constrains the model to available statewide datasets. The Vulnerability Model serves as a base growth prediction model developed on a ten year increment of data, projecting out to approximately ten years and more into the future. It is important for the end user to apply specific datasets as needed to make decisions with the model.

It is difficult to model parameters that influence growth and development, such as politics or economic influences, particularly at a statewide scale. Local knowledge should be applied to the model to assess the growth patterns and influences at a local scale.

Additional datasets that can be applied to the model to assess actual growth versus predicted growth may include:

- Soils data in an attempt to model septic sewer capacity as an influence on growth / development
- Economic development data to identify areas promoted for development, such as enterprise zones.
- Comprehensive plans
- Zoning information

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Table 1. List of cities and counties used in the final regression model.

LOCALITY
Alexandria
Alleghany
Arlington
Charlottesville
Chesterfield
Covington
Emporia
Fairfax City
Fairfax County
Galax
Hampton
Hanover
Harrisonburg
Henrico
Lancaster
Louisa
Madison
New Kent
Newport News
Norton
Pittsylvania
Poquoson
Prince George
Prince William
Radford
Richmond City
Roanoke City
Roanoke County
Salem
Surry
Sussex
VA Beach
Williamsburg
Winchester

Figure 1. PDC 1 LENOWISCO Vulnerability Model.

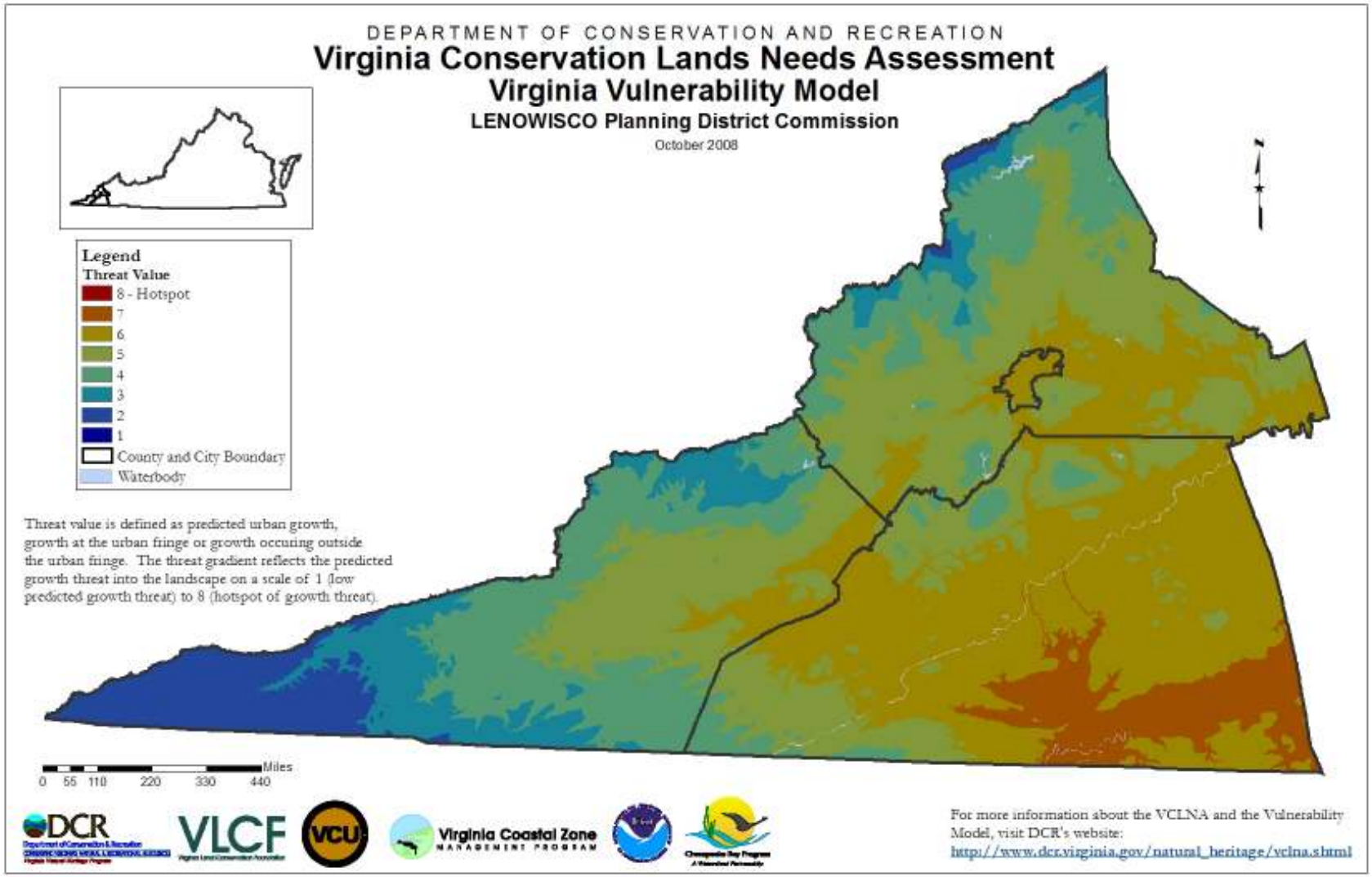


Figure 2. PDC 1 LENOWISCO Urban Vulnerability Model.

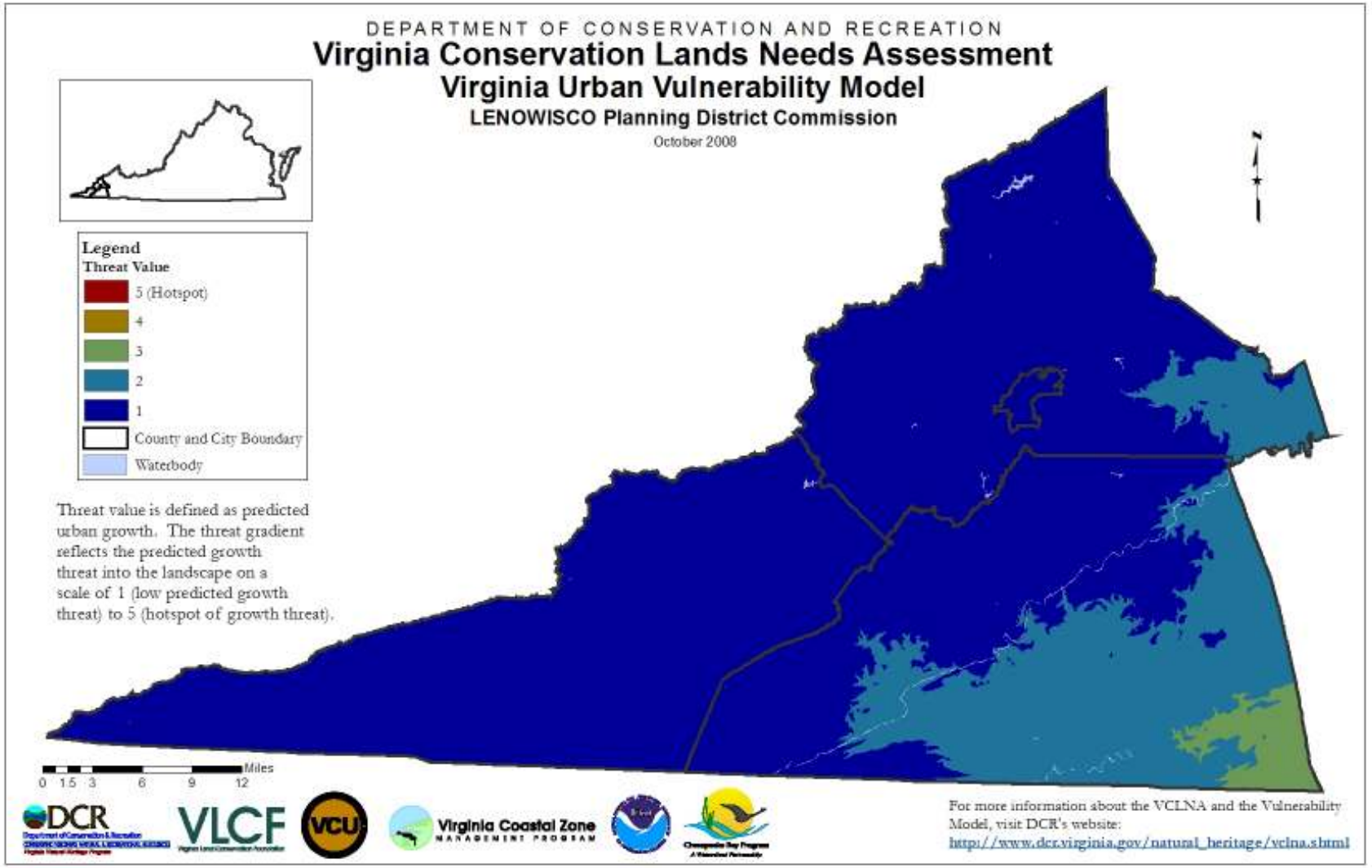


Figure 3. PDC 1 LENOWISCO Urban Fringe Vulnerability Model.

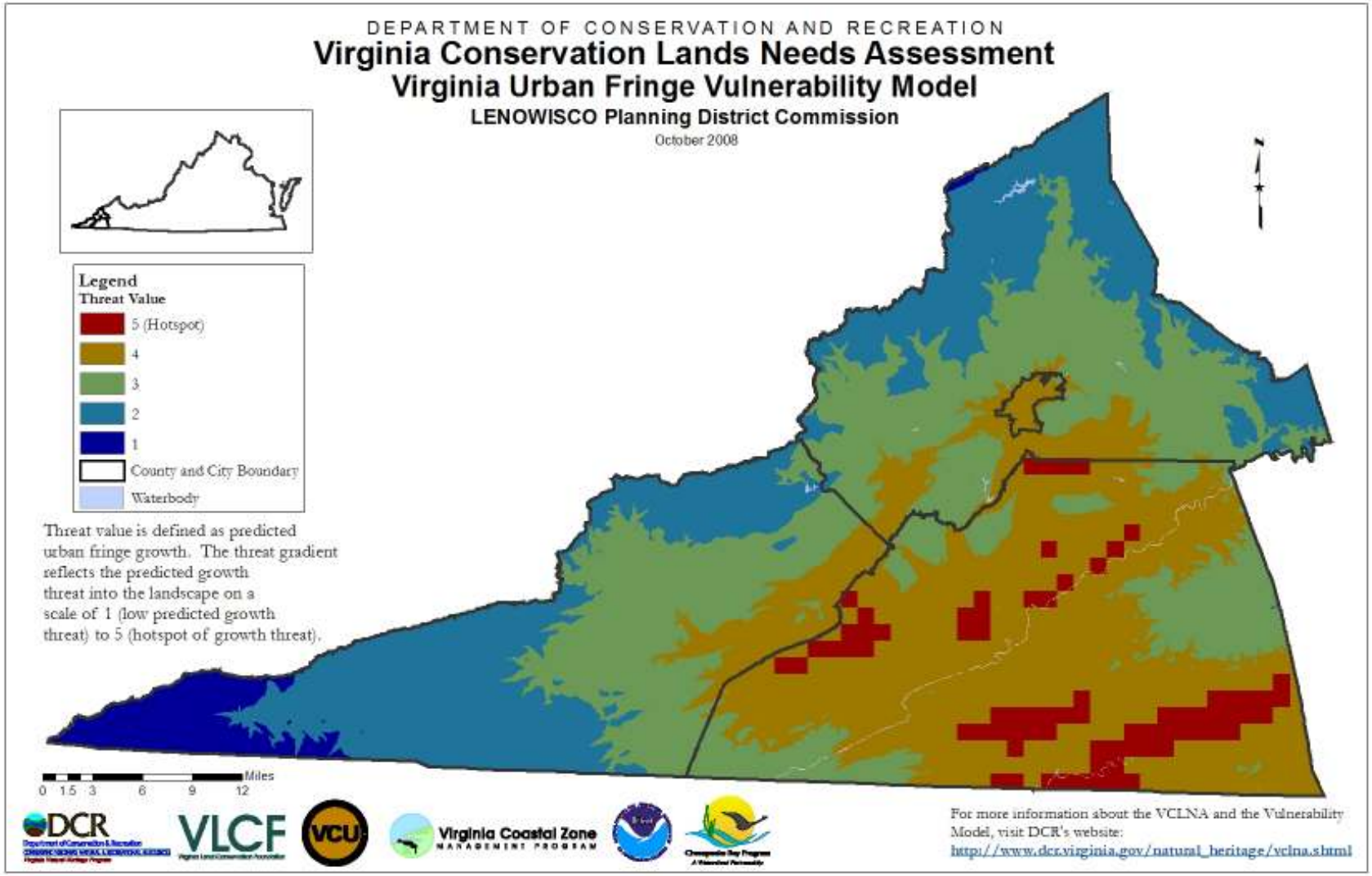


Figure 4. PDC 1 LENOWISCO Outside the Urban Fringe Vulnerability Model.

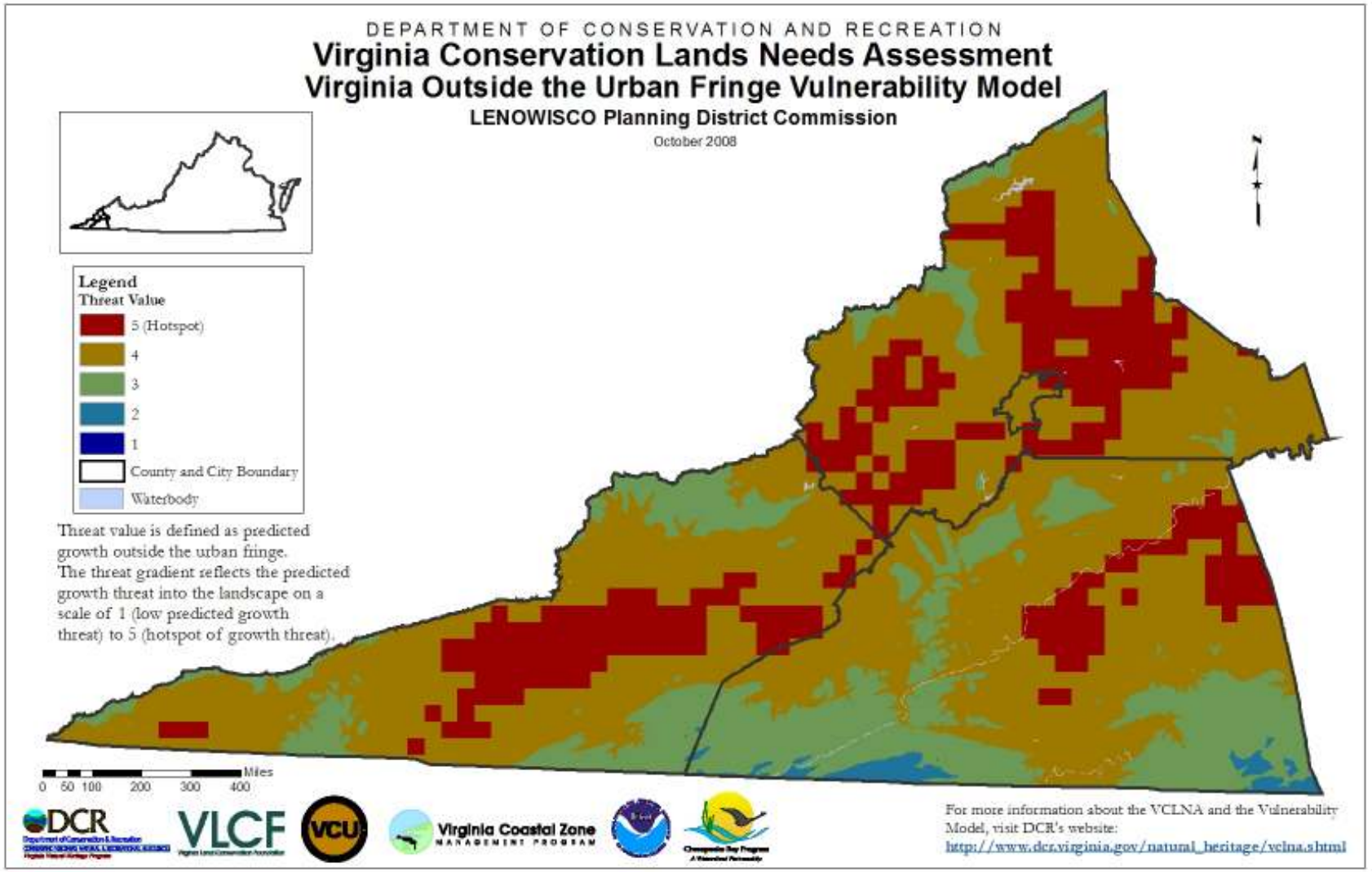


Figure 5. PDC 2 Cumberland Plateau Vulnerability Model.

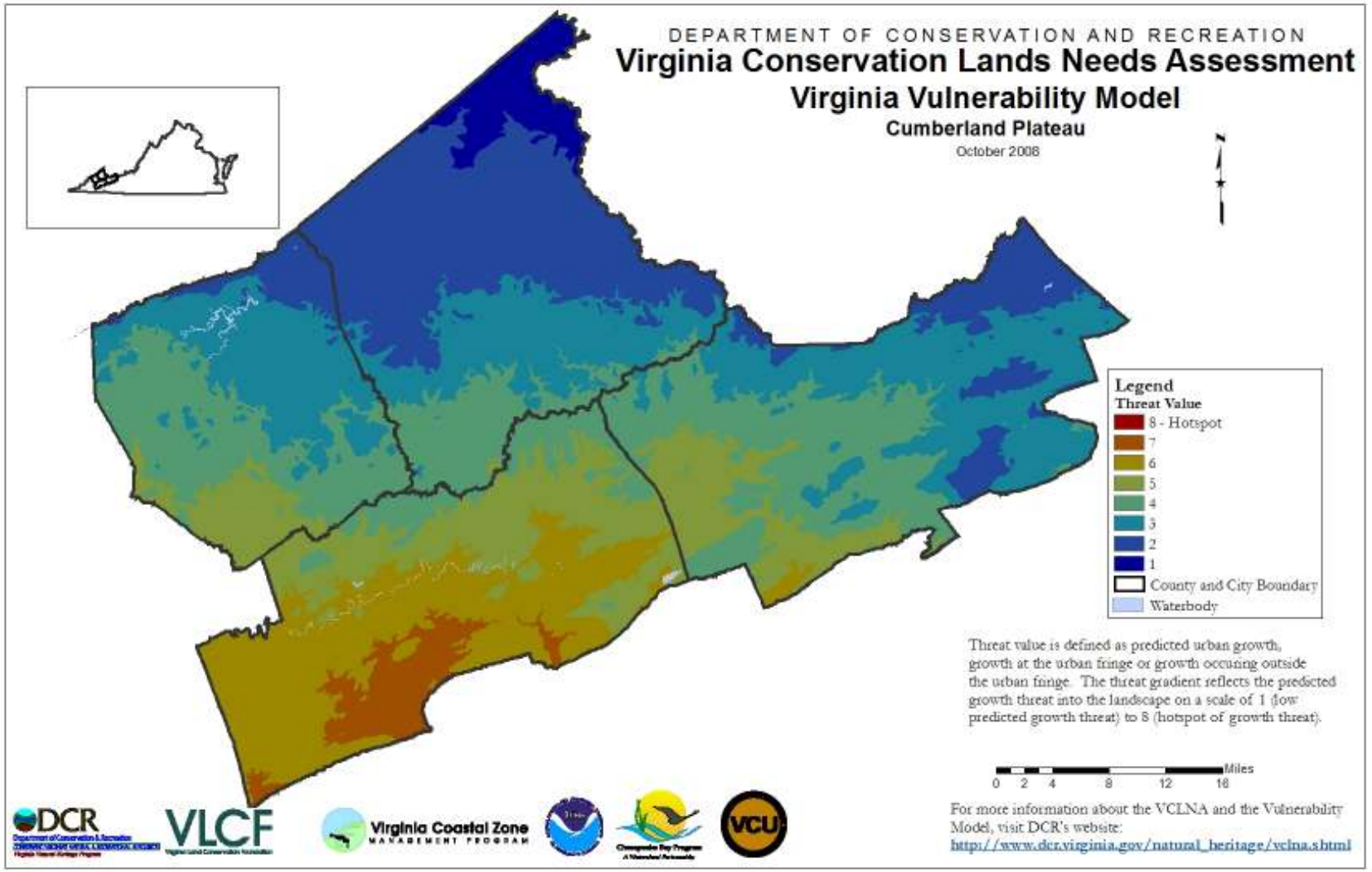


Figure 6. PDC 2 Cumberland Plateau Urban Vulnerability Model.

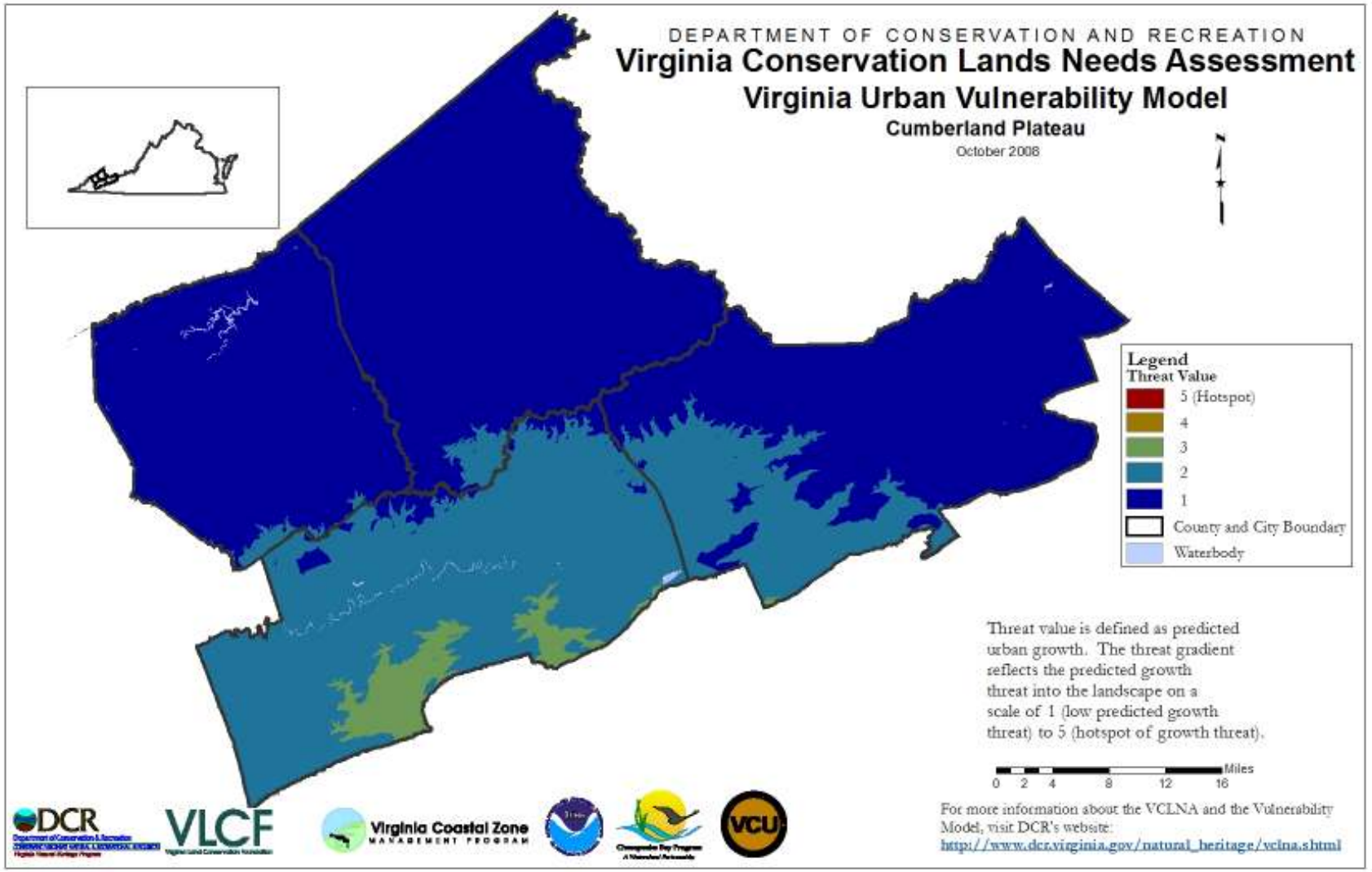


Figure 7. PDC 2 Cumberland Plateau Urban Fringe Vulnerability Model.

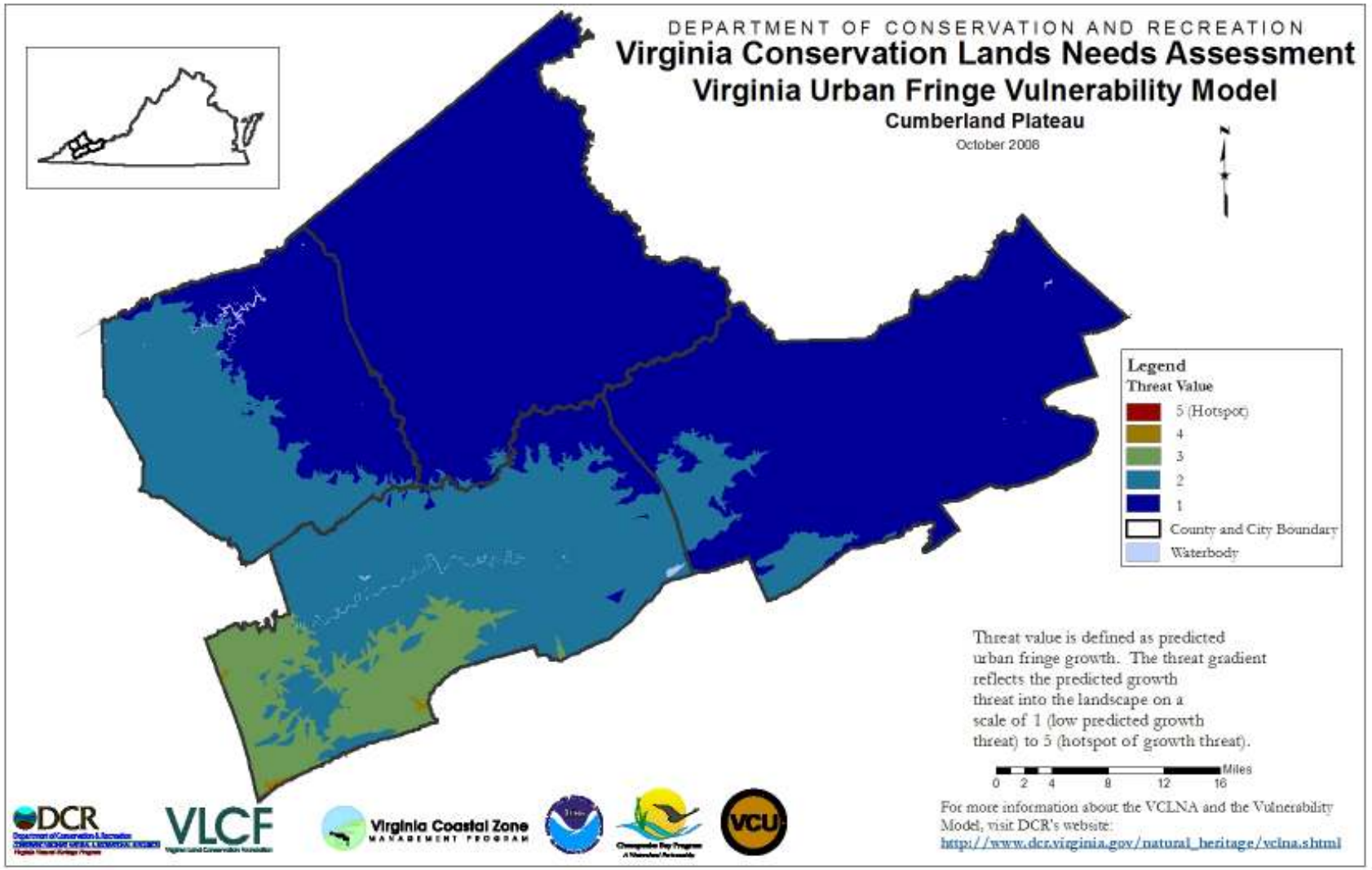


Figure 8. PDC 2 Cumberland Plateau Outside the Urban Fringe Vulnerability Model.

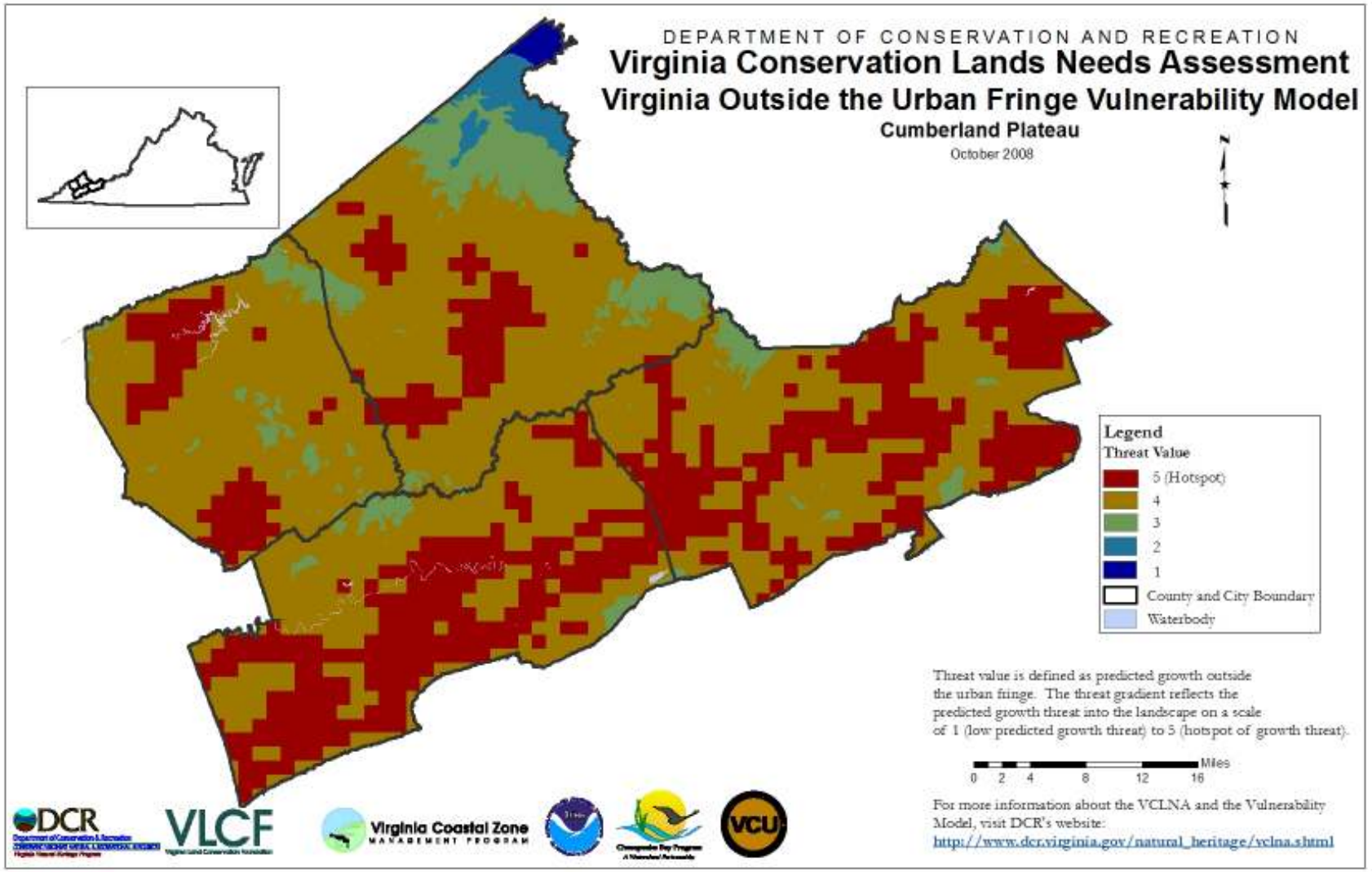


Figure 9. PDC 3 Mount Rogers Vulnerability Model

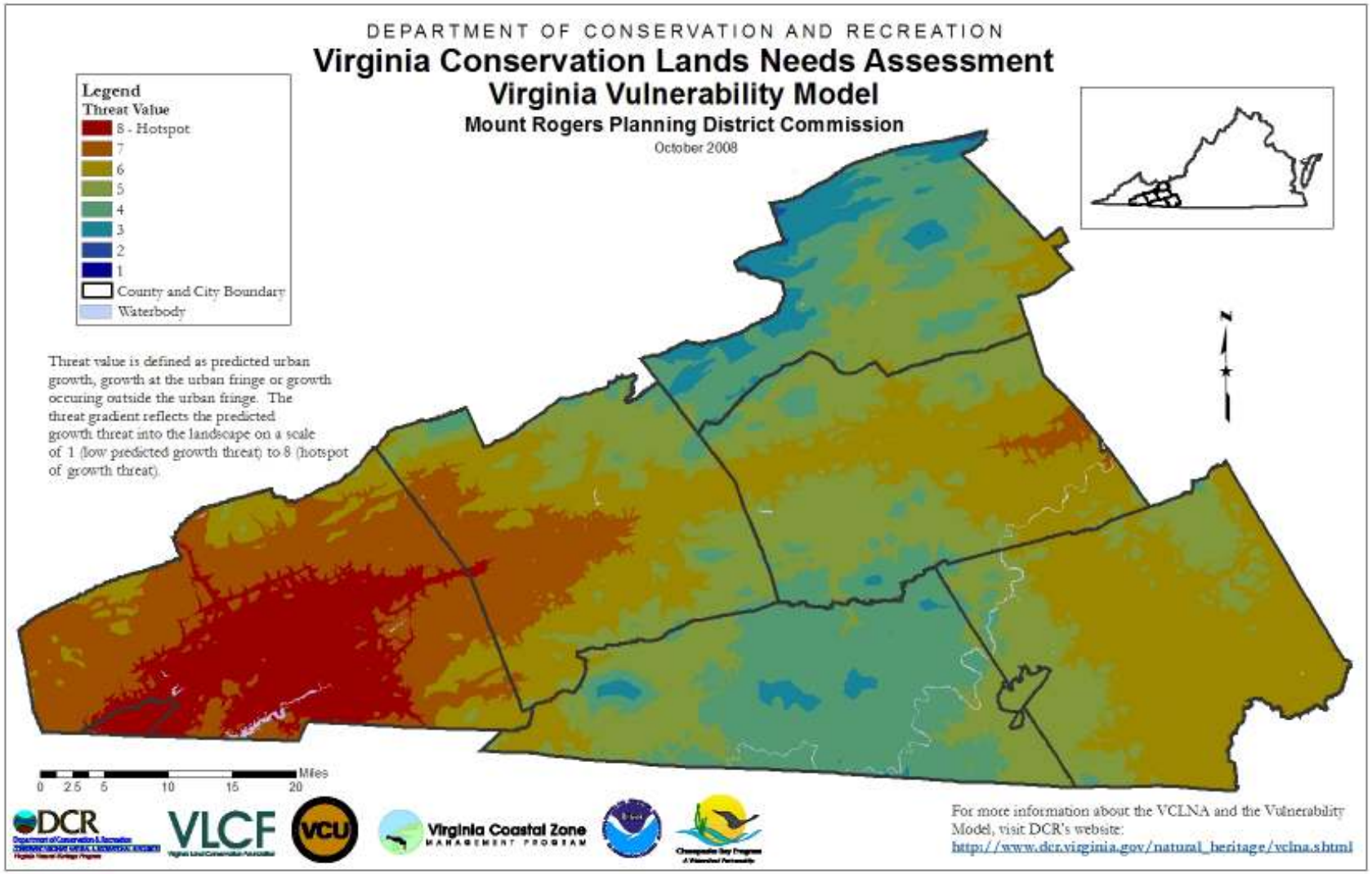


Figure 10. PDC 3 Mount Rogers Urban Vulnerability Model

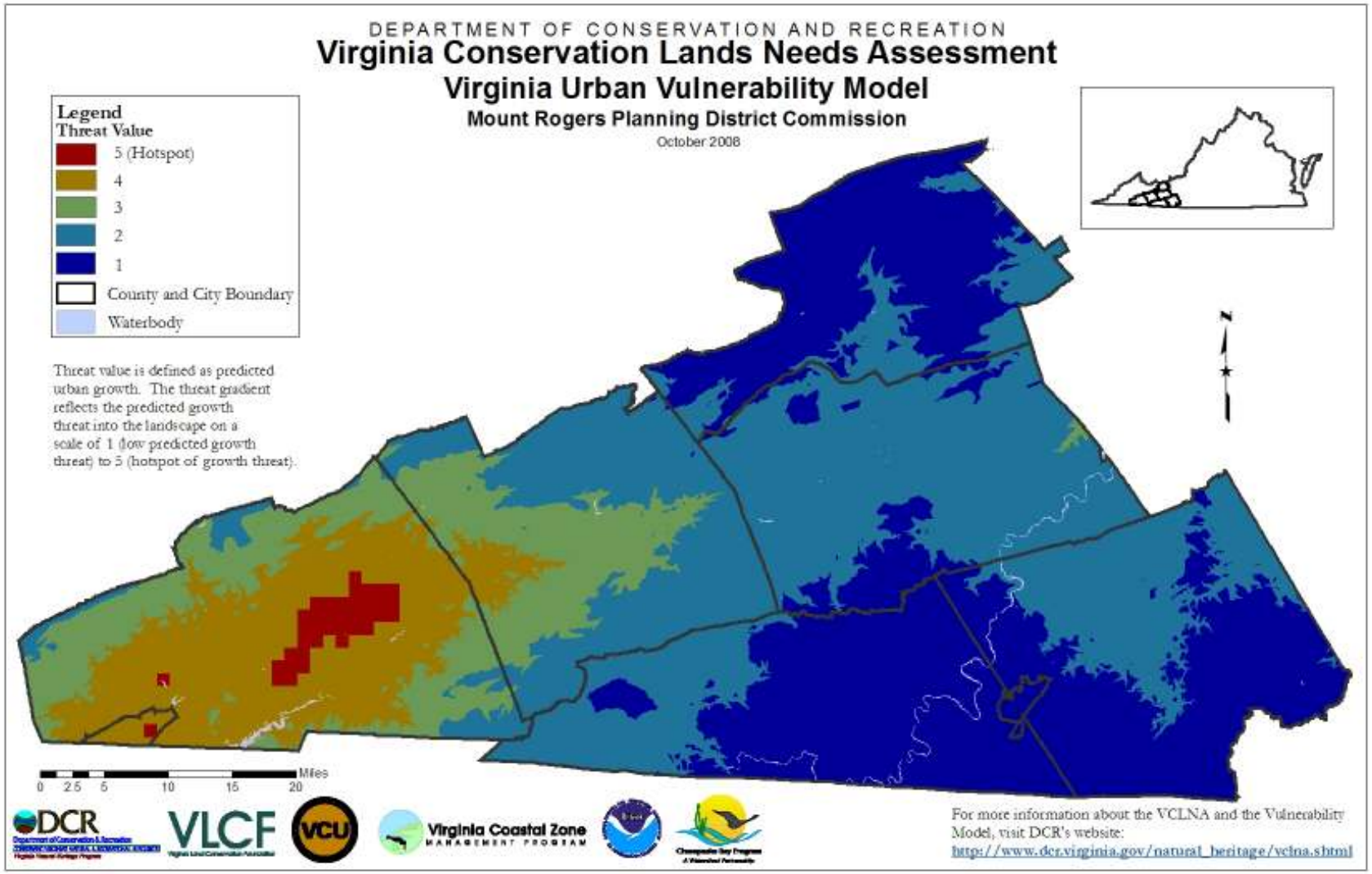


Figure 11. PDC 3 Mount Rogers Urban Fringe Vulnerability Model

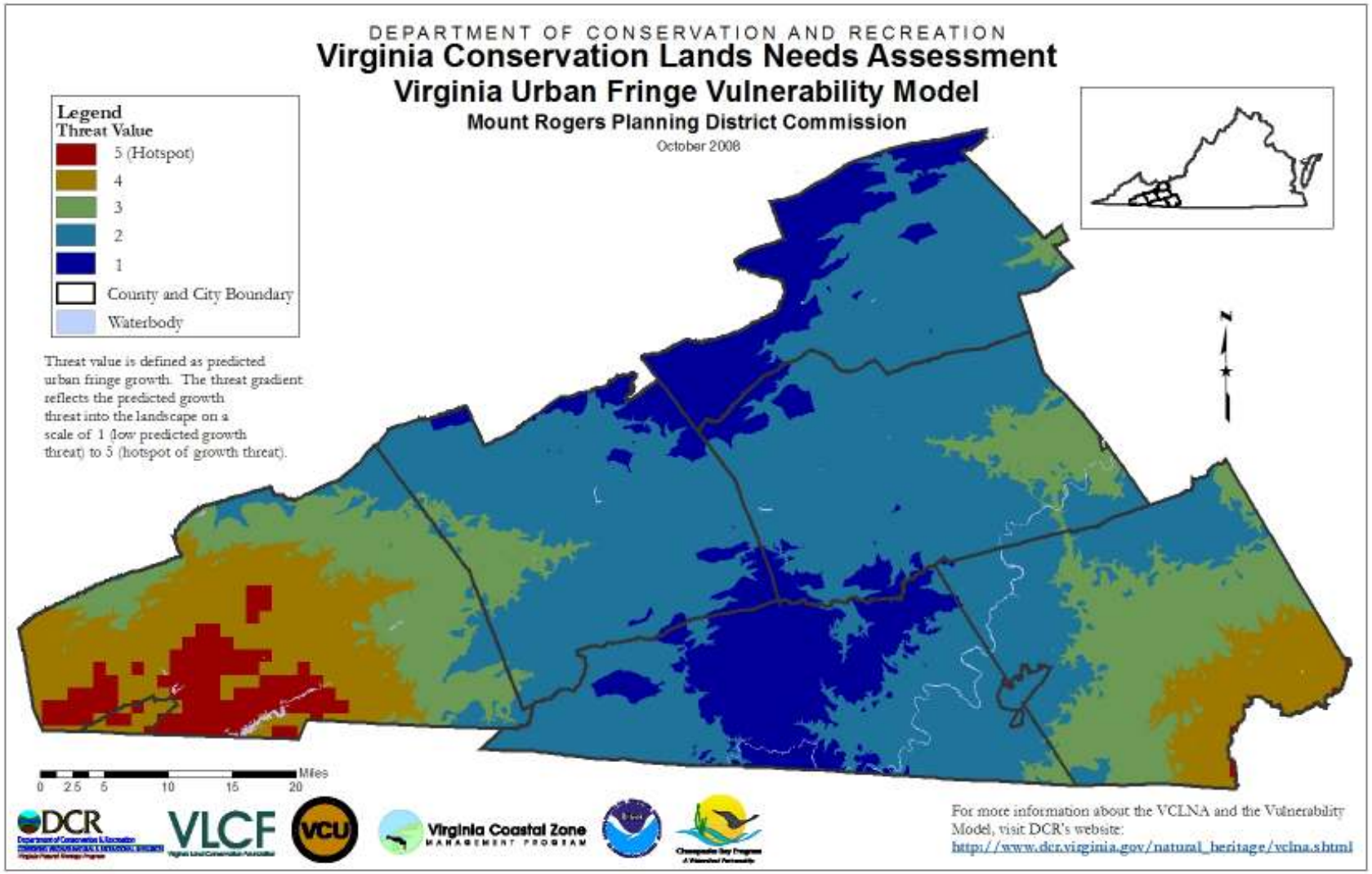


Figure 12. PDC 3 Mount Rogers Growth Outside the Urban Fringe Vulnerability Model

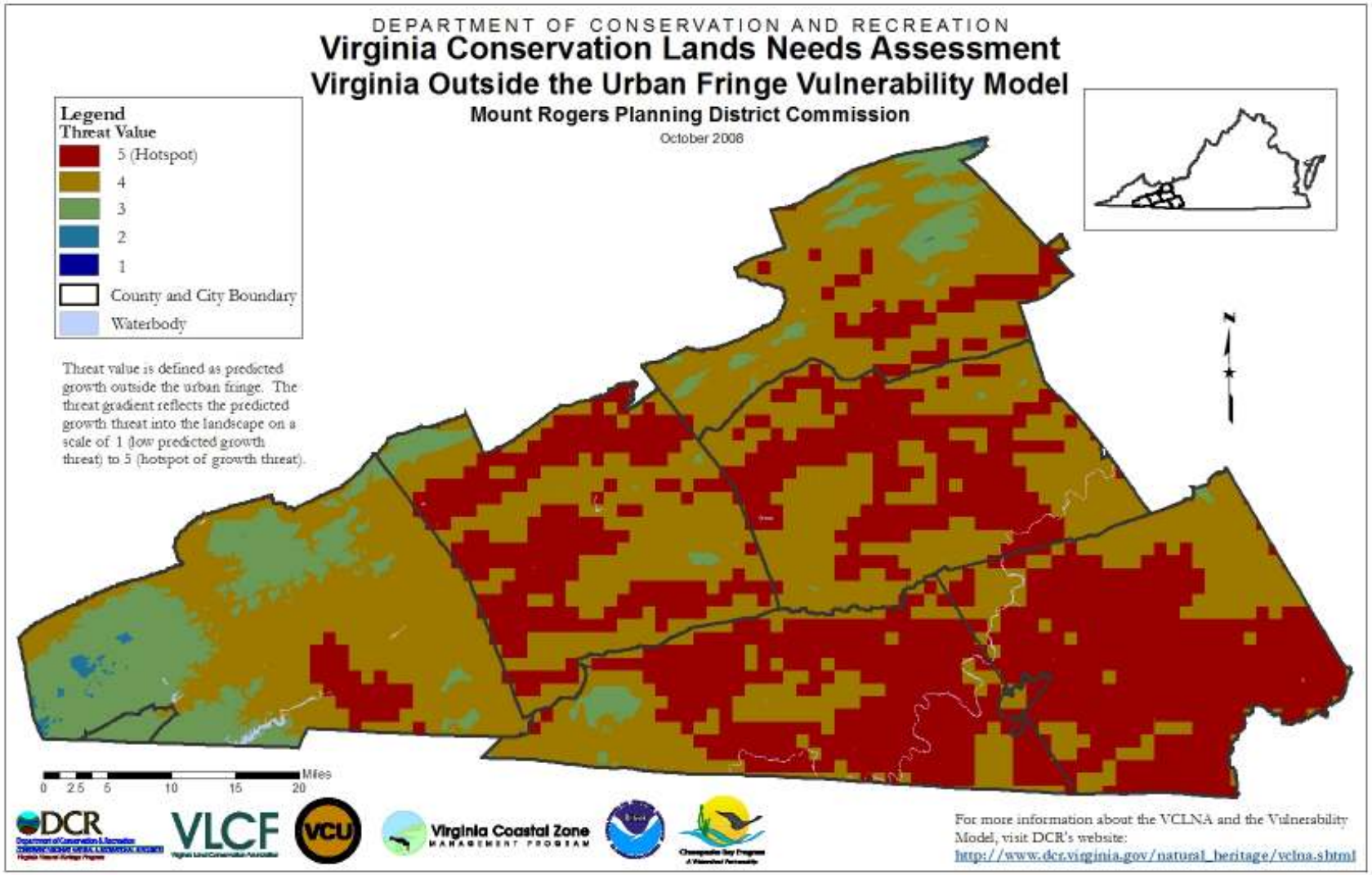


Figure 13. PDC 4 New River Valley Vulnerability Model

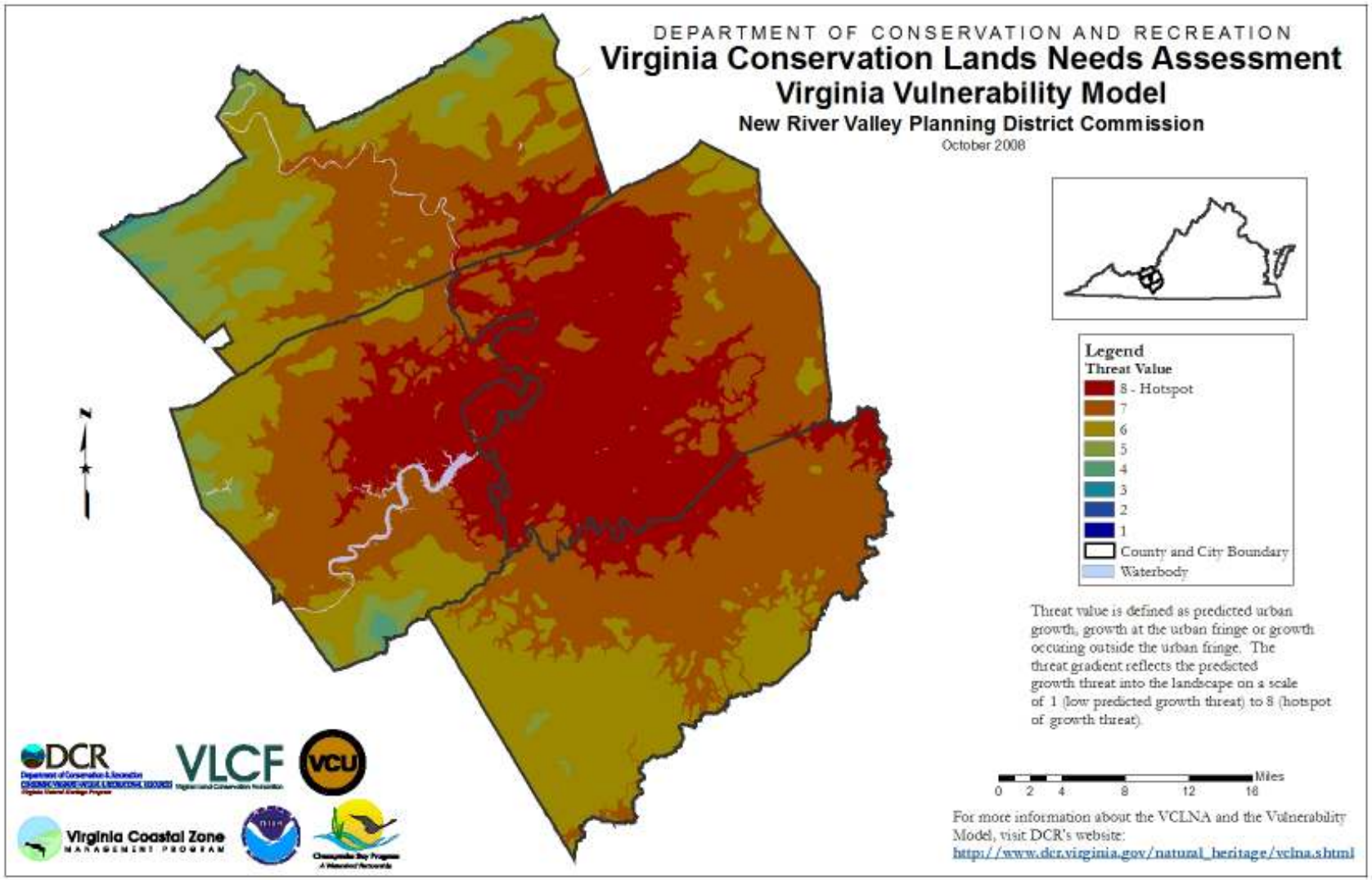


Figure 14. PDC 4 New River Valley Urban Vulnerability Model

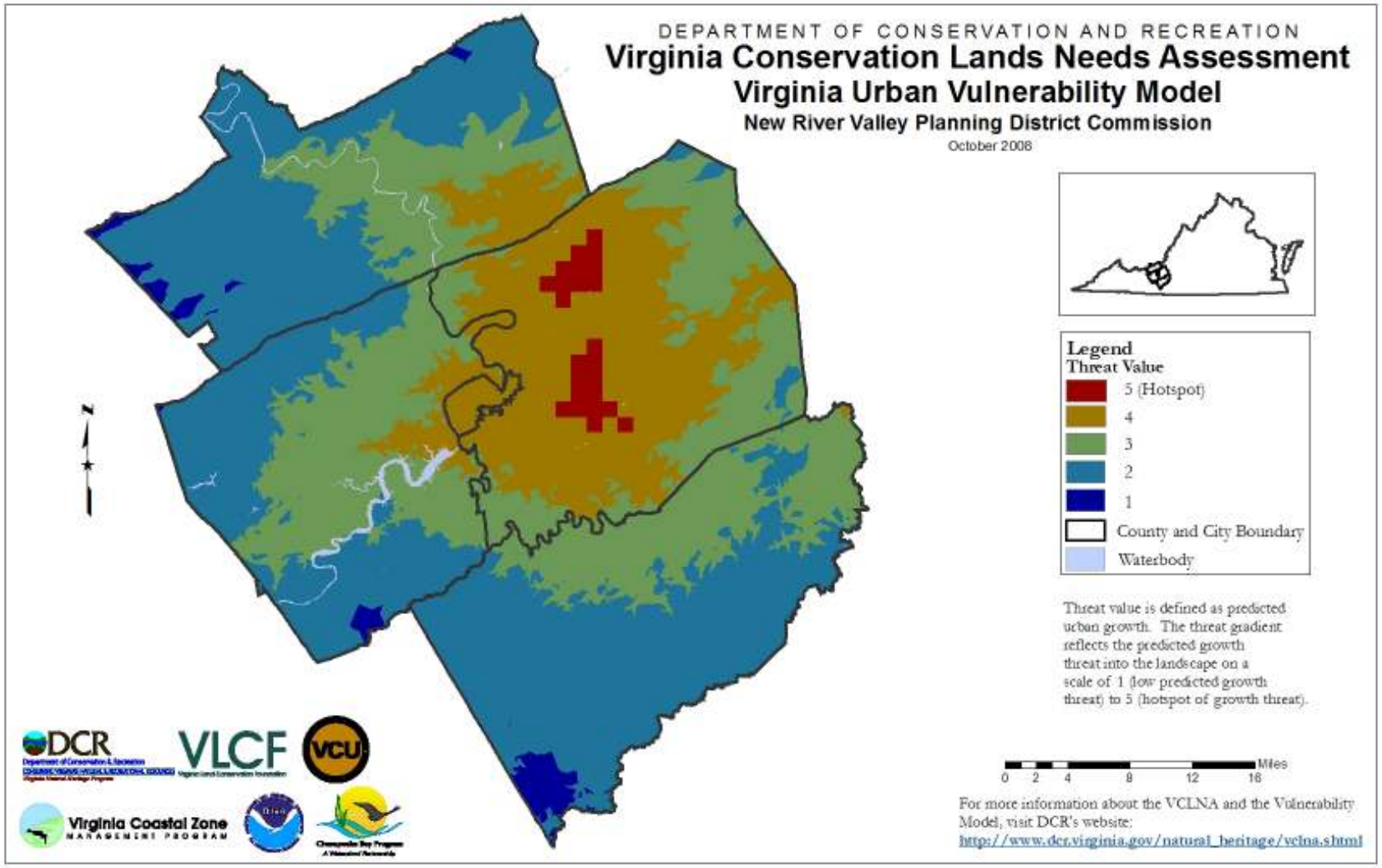


Figure 15. PDC 4 New River Valley Urban Fringe Vulnerability Model

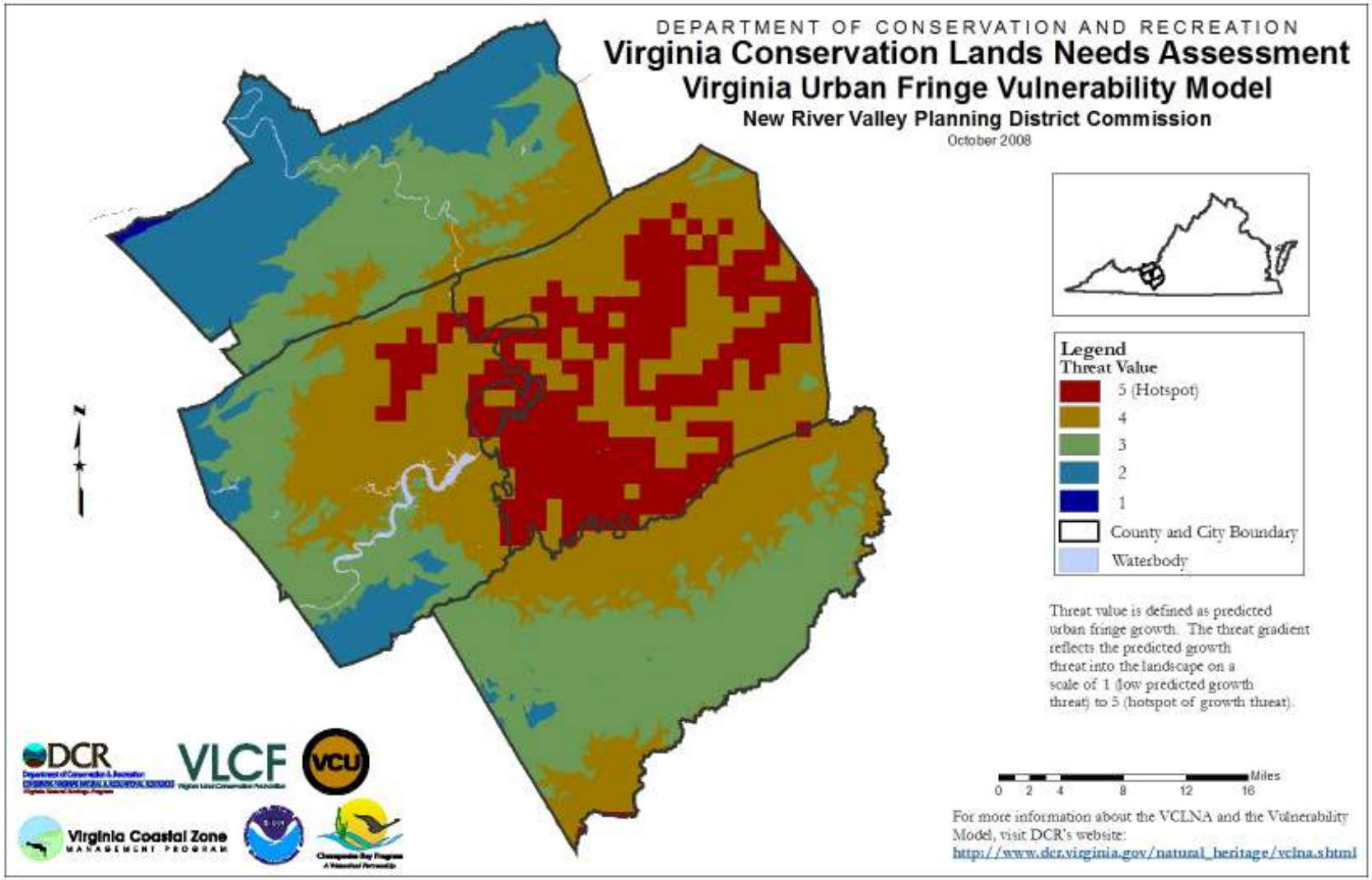


Figure 16. PDC 4 New River Valley Growth Outside the Urban Fringe Vulnerability Model

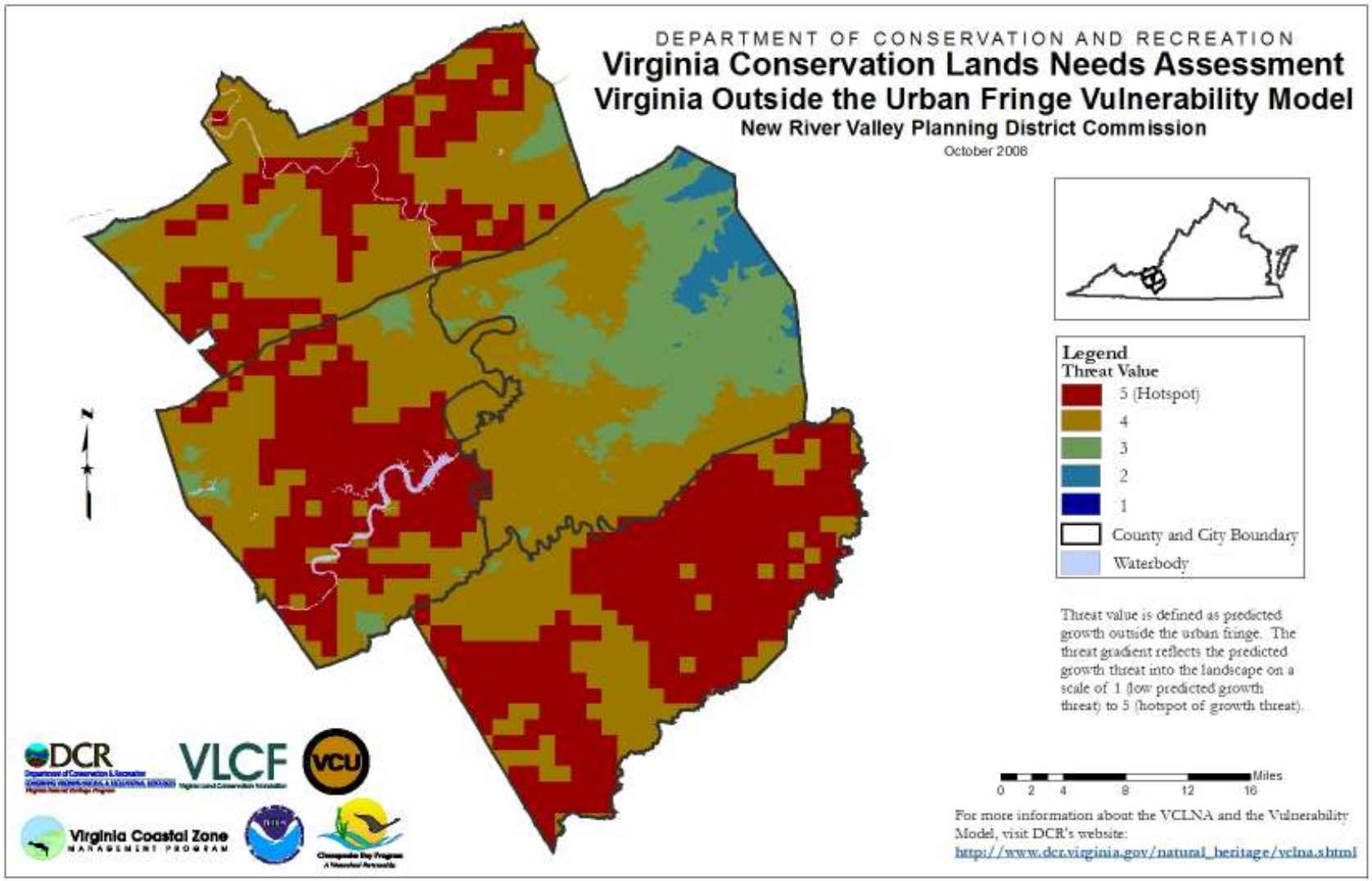


Figure 17. PDC 5 Roanoke Valley-Alleghany Regional Commission Vulnerability Model.

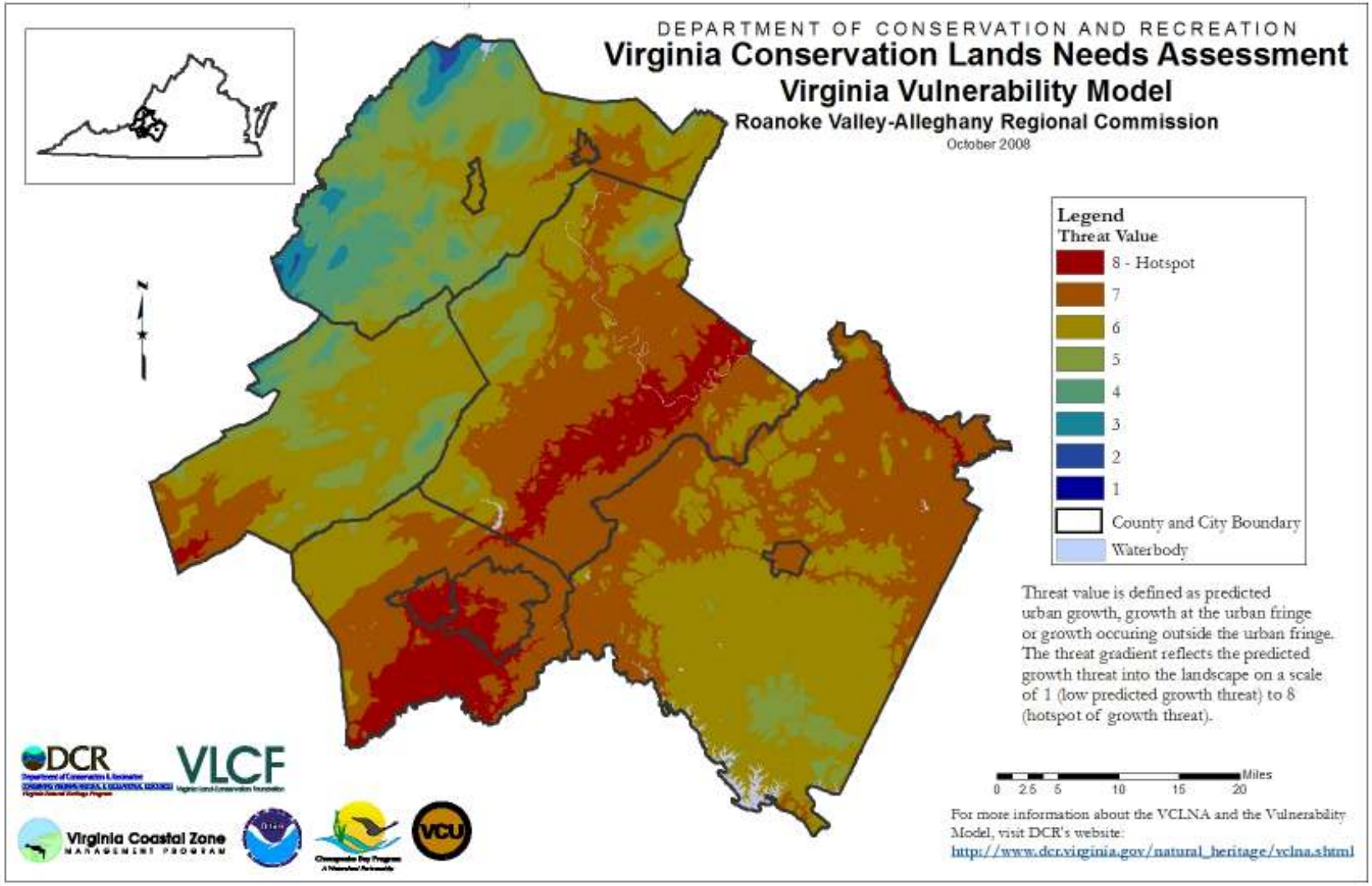


Figure 18. PDC 5 Roanoke Valley-Alleghany Regional Commission Urban Vulnerability Model.

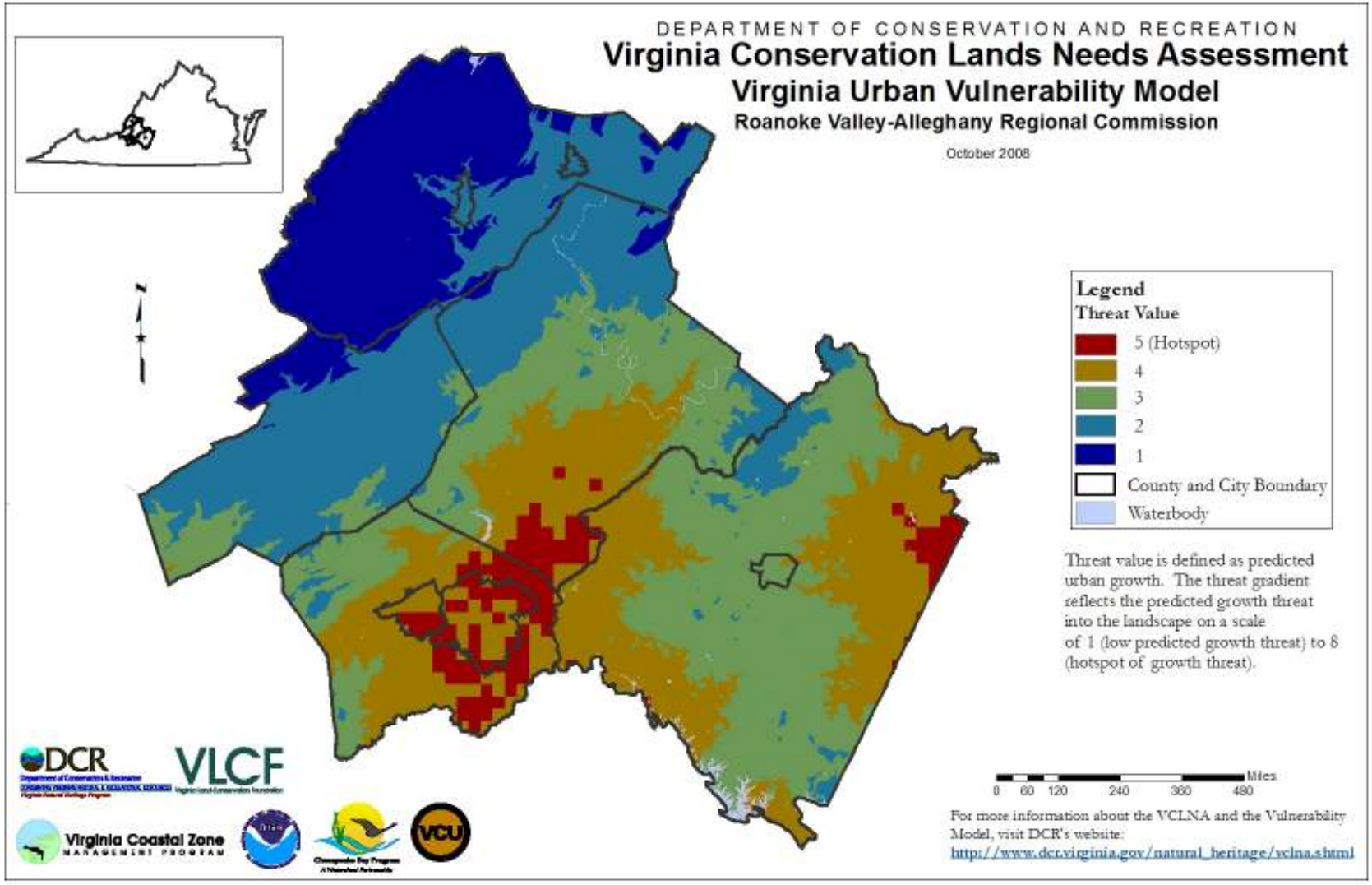


Figure 19. PDC 5 Roanoke Valley-Alleghany Regional Commission Urban Fringe Vulnerability Model.

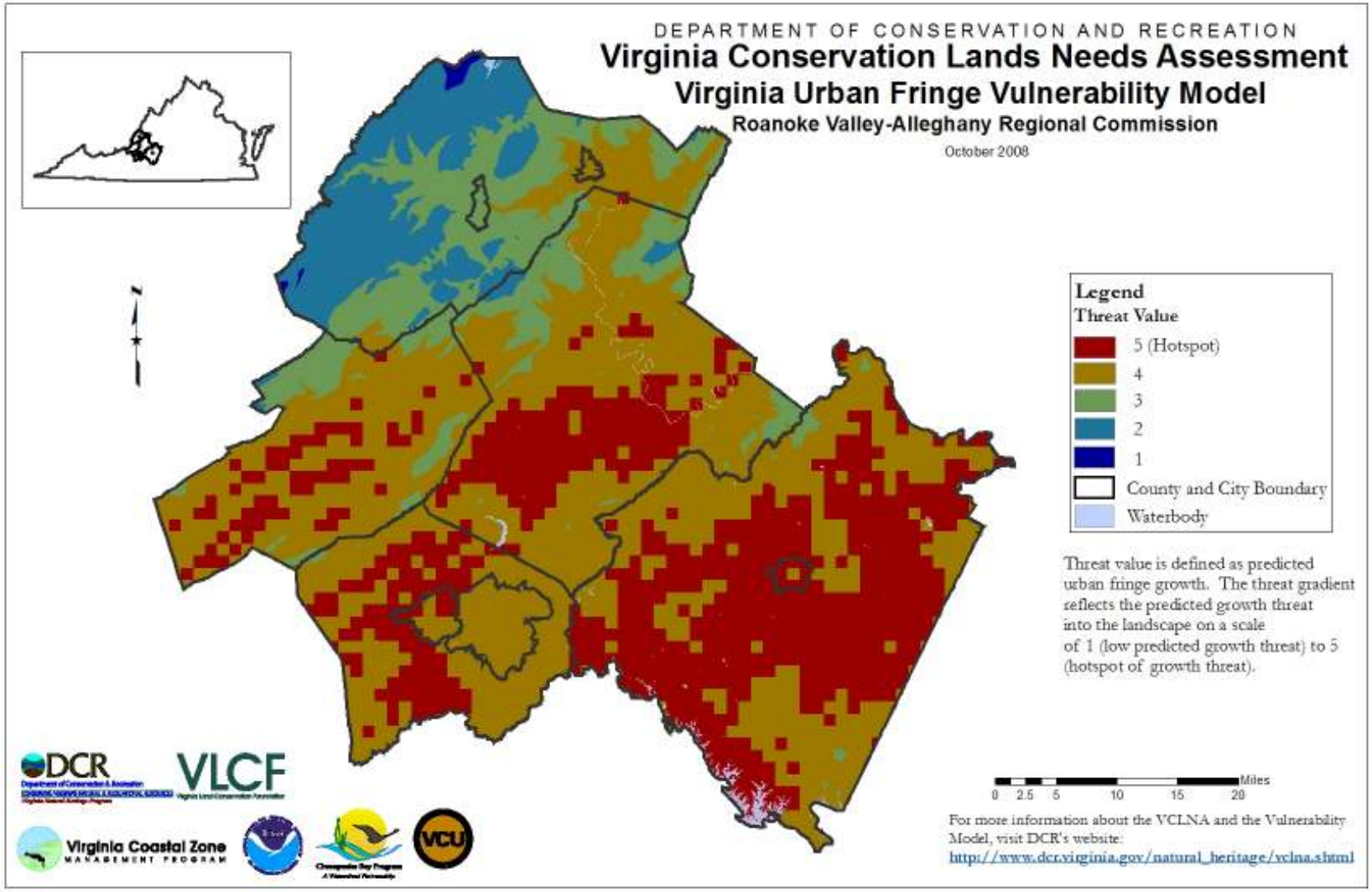


Figure 20. PDC 5 Roanoke Valley-Alleghany Regional Commission Outside the Urban Fringe Vulnerability Model.

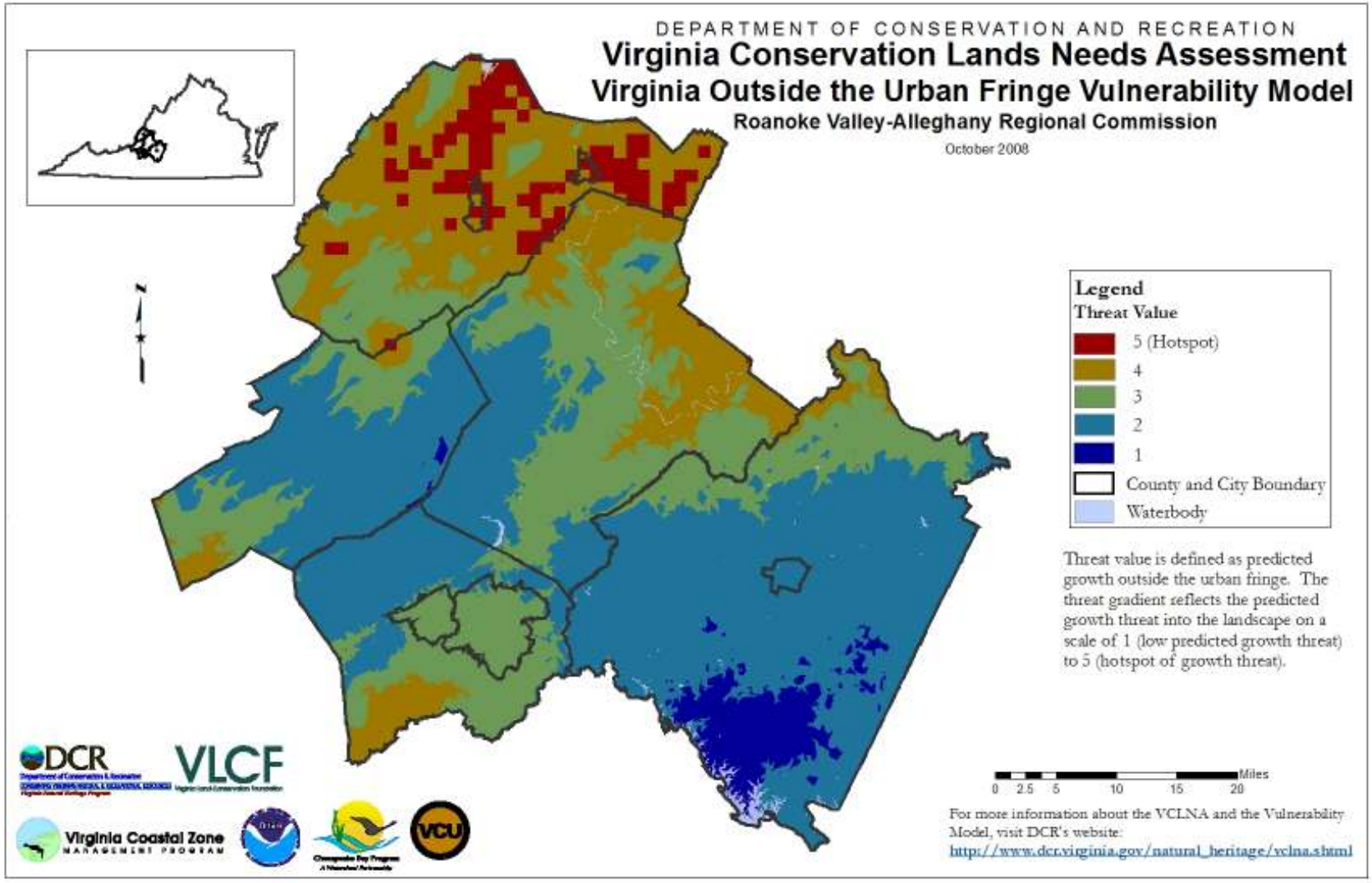


Figure 21. PDC 6 Central Shenandoah Vulnerability Model.

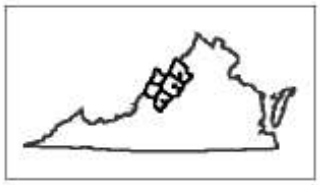
DEPARTMENT OF CONSERVATION AND RECREATION

Virginia Conservation Lands Needs Assessment

Virginia Vulnerability Model

Central Shenandoah Planning District Commission

October 2008



Threat value is defined as predicted urban growth, growth at the urban fringe or growth occuring outside the urban fringe. The threat gradient reflects the predicted growth threat into the landscape on a scale of 1 (low predicted growth threat) to 8 (hotspot of growth threat).

For more information about the VCLNA and the Vulnerability Model, visit DCR's website:
http://www.dcr.virginia.gov/natural_heritage/vclna.shtml

Figure 22. PDC 6 Central Shenandoah Urban Vulnerability Model.

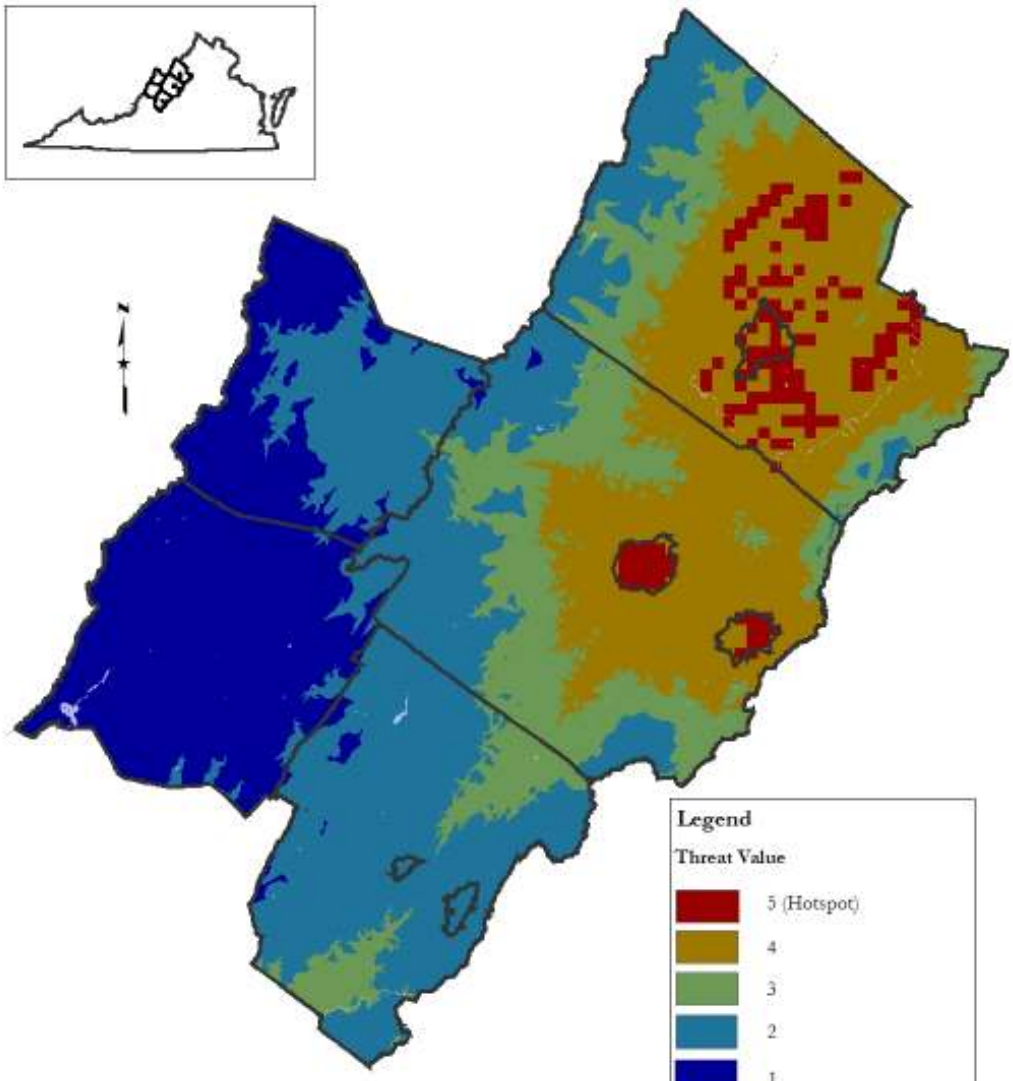
DEPARTMENT OF CONSERVATION AND RECREATION

Virginia Conservation Lands Needs Assessment

Virginia Urban Vulnerability Model

Central Shenandoah Planning District Commission

October 2006



Threat value is defined as predicted urban fringe growth. The threat gradient reflects the predicted growth threat into the landscape on a scale of 1 (low predicted growth threat) to 5 (hotspot of growth threat).

For more information about the VCLNA and the Vulnerability Model, visit DCR's website:
http://www.dcr.virginia.gov/natural_heritage/vclna.shtml

DCR VLCF VCU Virginia Coastal Zone MANAGEMENT PROGRAM

Figure 23. PDC 6 Central Shenandoah Urban Fringe Vulnerability Model.

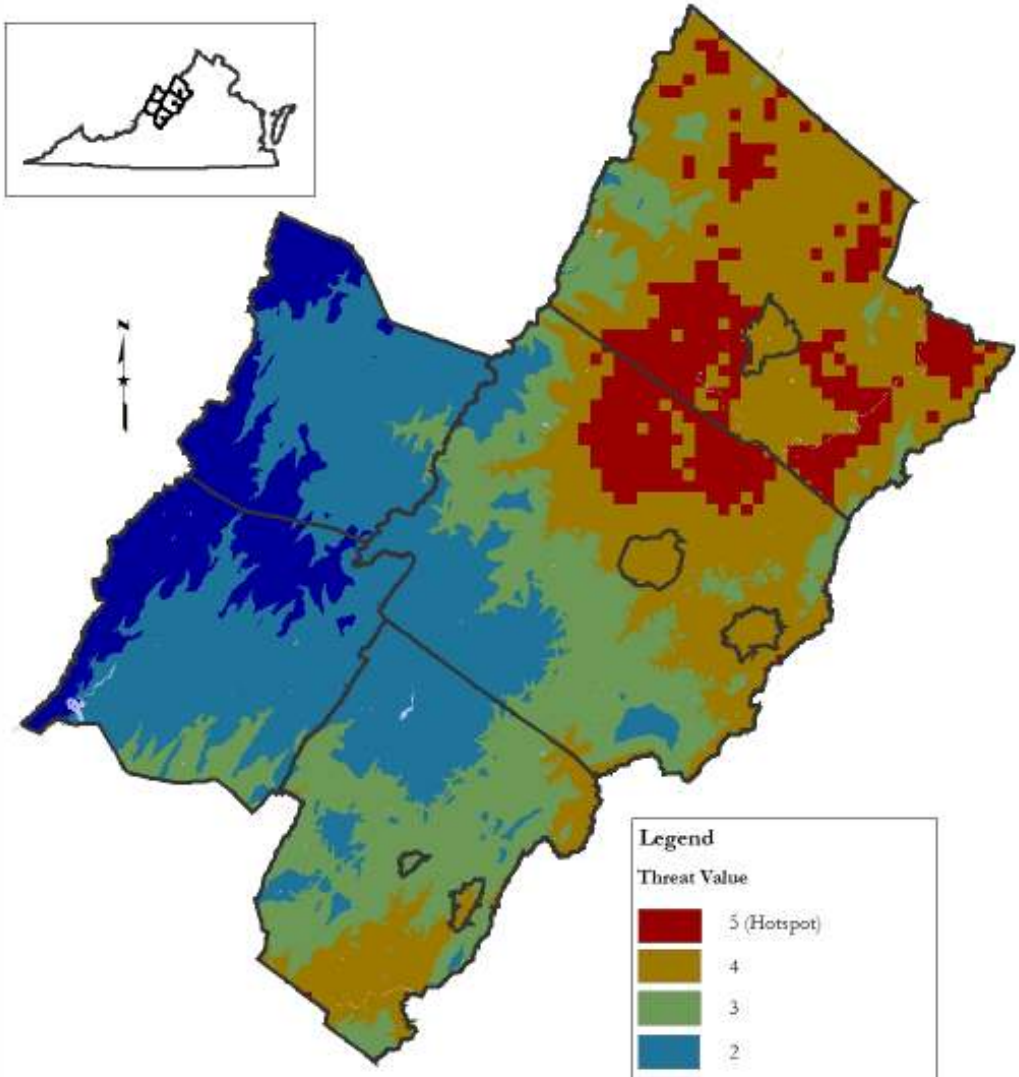
DEPARTMENT OF CONSERVATION AND RECREATION

Virginia Conservation Lands Needs Assessment

Virginia Urban Fringe Vulnerability Model

Central Shenandoah Planning District Commission

October 2008



Threat value is defined as predicted urban fringe growth. The threat gradient reflects the predicted growth threat into the landscape on a scale of 1 (low predicted growth threat) to 5 (hotspot of growth threat).

For more information about the VCLNA and the Vulnerability Model, visit DCR's website:
http://www.dcr.virginia.gov/natural_heritage/vclna.shtml

DCR Department of Conservation & Recreation
VLCF Virginia Land Conservation Foundation
VCU
Virginia Coastal Zone MANAGEMENT PROGRAM
Chesapeake Bay Program

Figure 24. PDC 6 Central Shenandoah Outside the Urban Fringe Vulnerability Model.

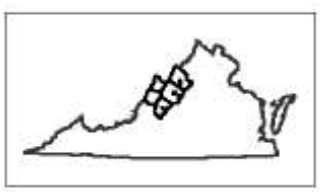
DEPARTMENT OF CONSERVATION AND RECREATION

Virginia Conservation Lands Needs Assessment

Virginia Outside the Urban Fringe Vulnerability Model

Central Shenandoah Planning District Commission

October 2008



Legend

Threat Value

- 5 (Hotspot)
- 4
- 3
- 2
- 1
- County and City Boundary
- Waterbody

0 3 6 12 18 24 Miles

Threat value is defined as predicted growth outside the urban fringe. The threat gradient reflects the predicted growth threat into the landscape on a scale of 1 (low predicted growth threat) to 5 (hotspot of growth threat).

For more information about the VCLNA and the Vulnerability Model, visit DCR's website:
http://www.dcr.virginia.gov/natural_heritage/vclna.shtml

DCR Department of Conservation & Recreation

VLCF Virginia Land Conservation Foundation

VCU

Virginia Coastal Zone MANAGEMENT PROGRAM

Chesapeake Bay Program

Figure 25. PDC 7 Northern Shenandoah Valley Regional Commission Vulnerability Model

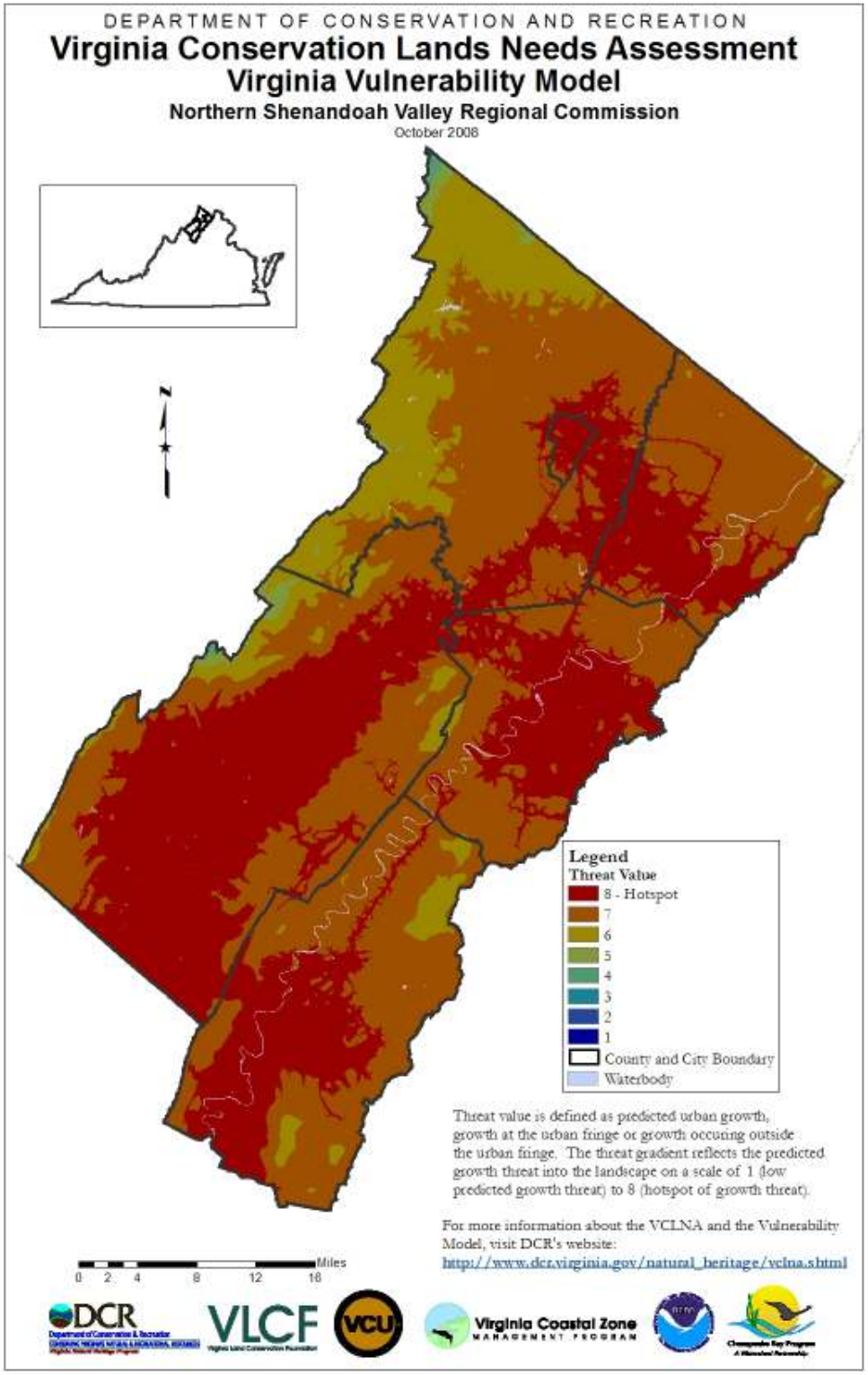


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Figure 26. PDC 7 Northern Shenandoah Valley Regional Commission Urban Vulnerability Model.

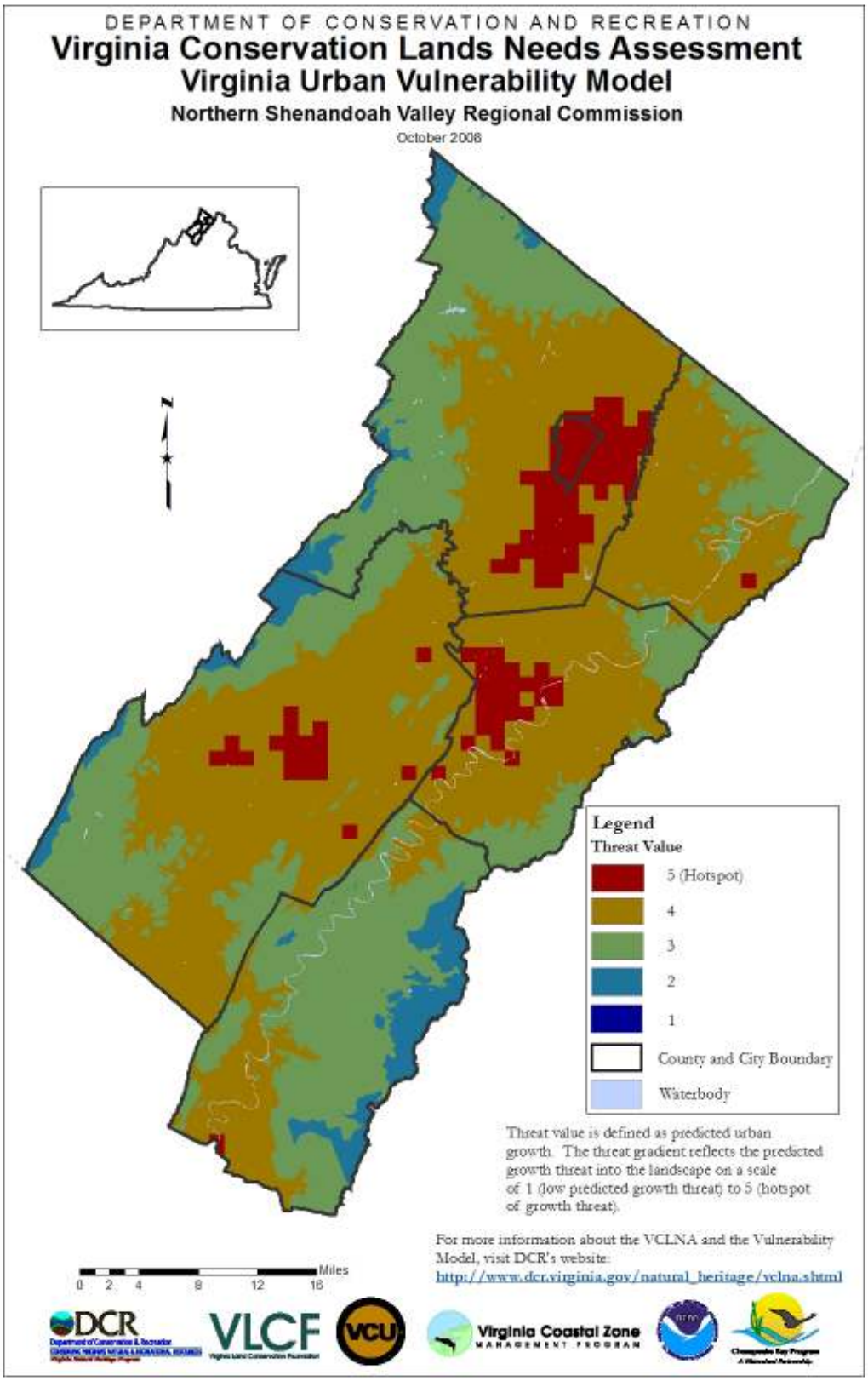


Figure 27. PDC 7 Northern Shenandoah Valley Regional Commission Urban Fringe Vulnerability Model.

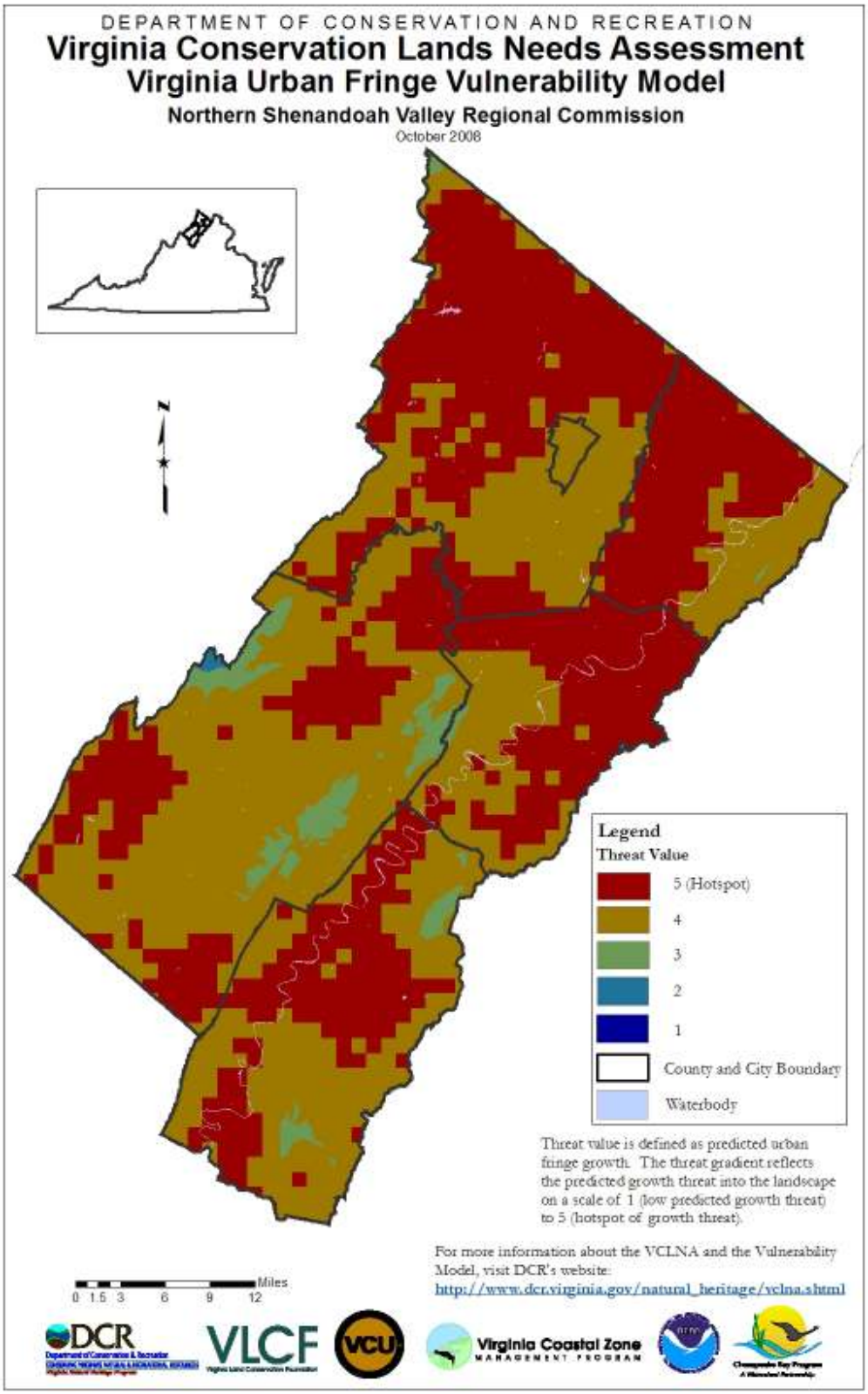


Figure 28. PDC 7 Northern Shenandoah Valley Regional Commission Outside the Urban Fringe Vulnerability Model.

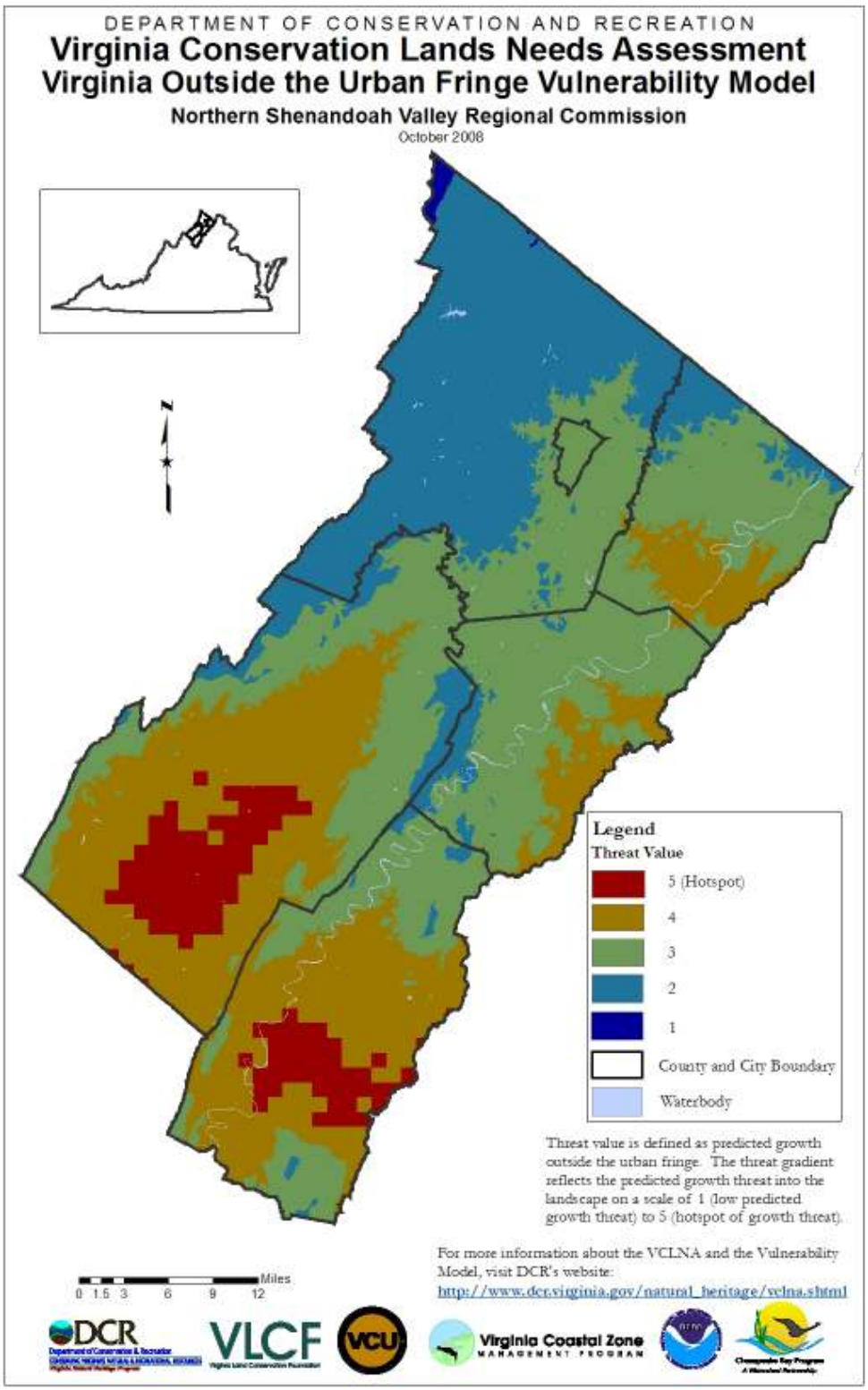


Figure 29. PDC 8 Northern Virginia Regional Commission Vulnerability Model.

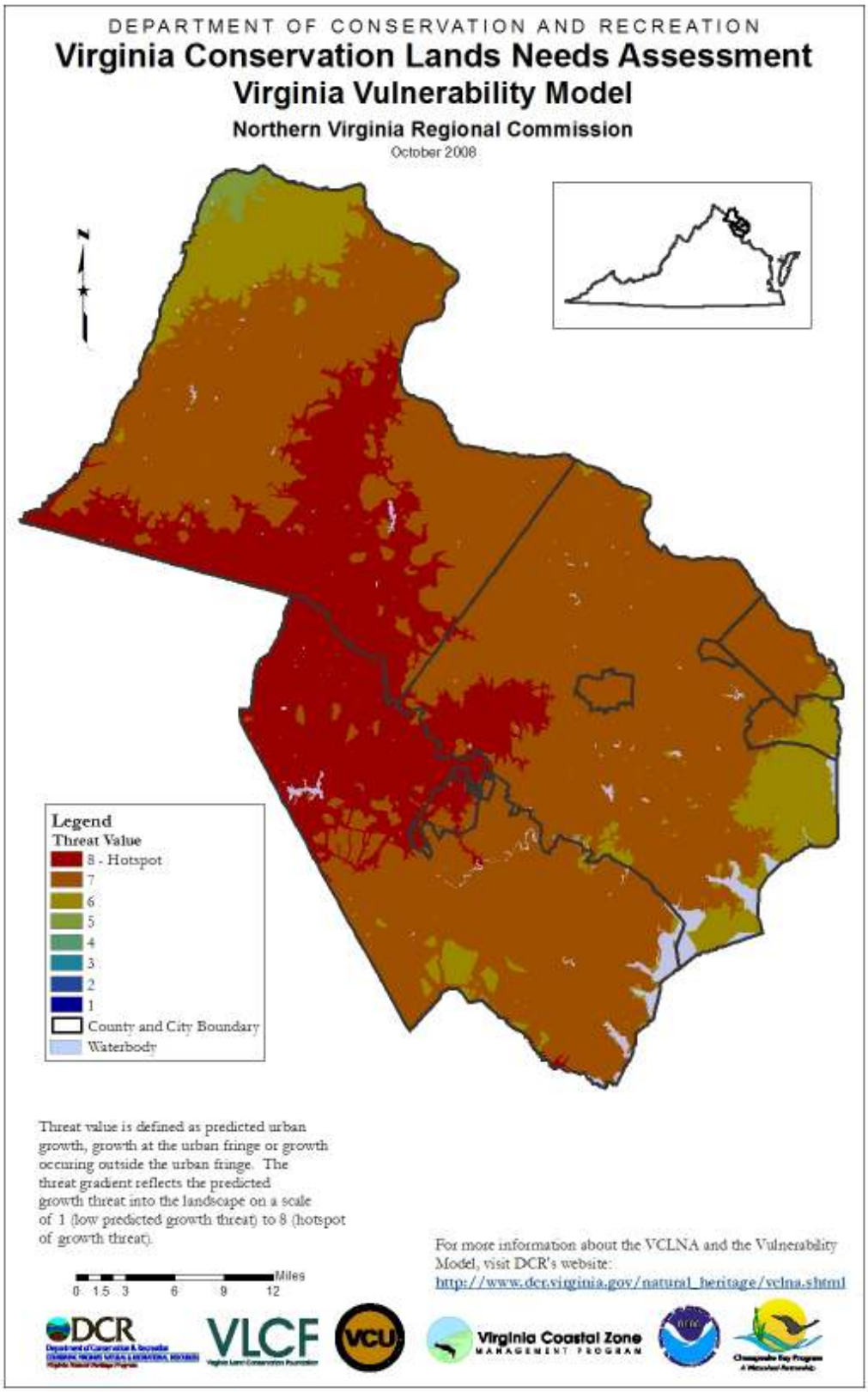


Figure 30. PDC 8 Northern Virginia Regional Commission Urban Vulnerability Model.

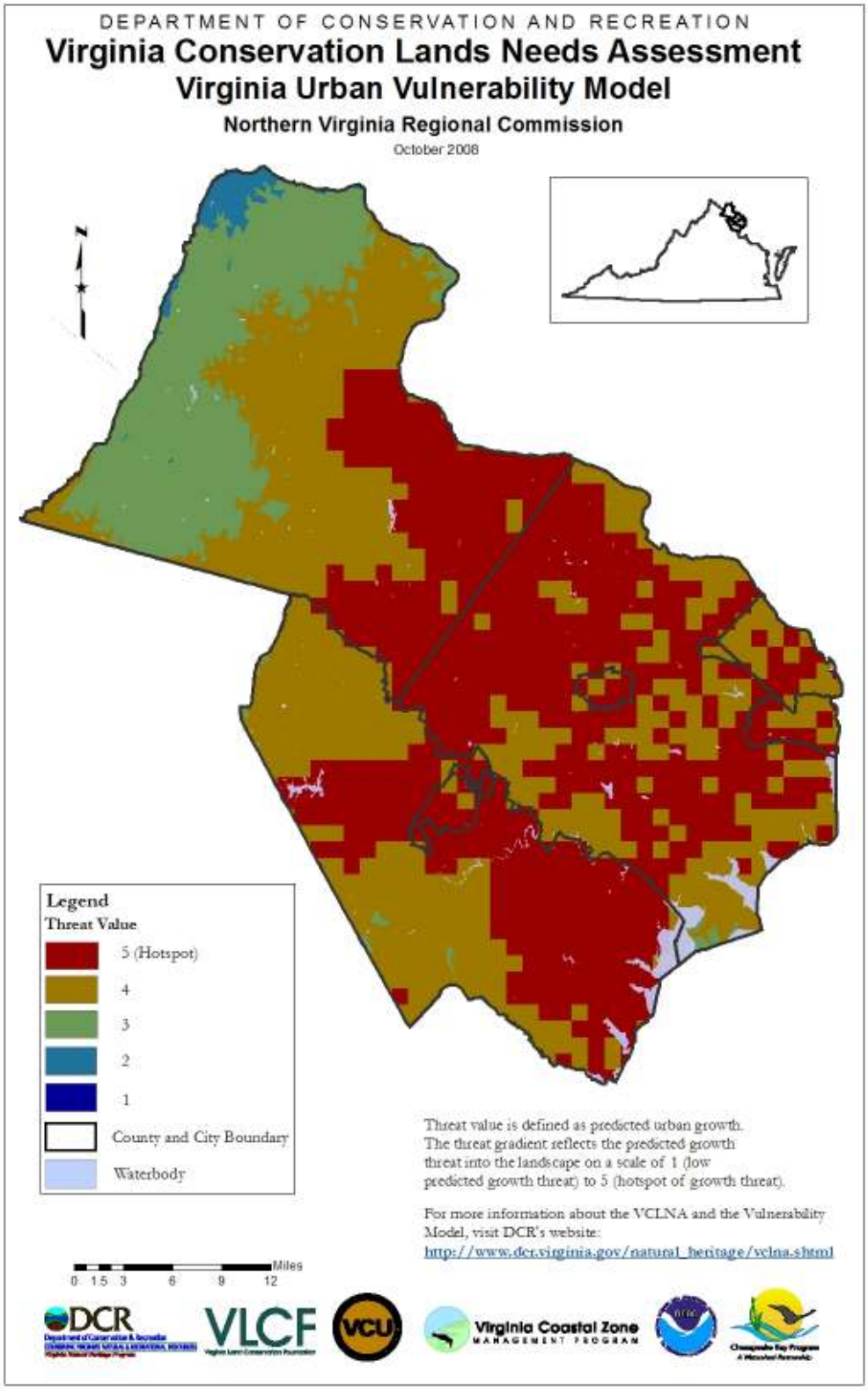


Figure 31. PDC 8 Northern Virginia Regional Commission Urban Fringe Vulnerability Model.

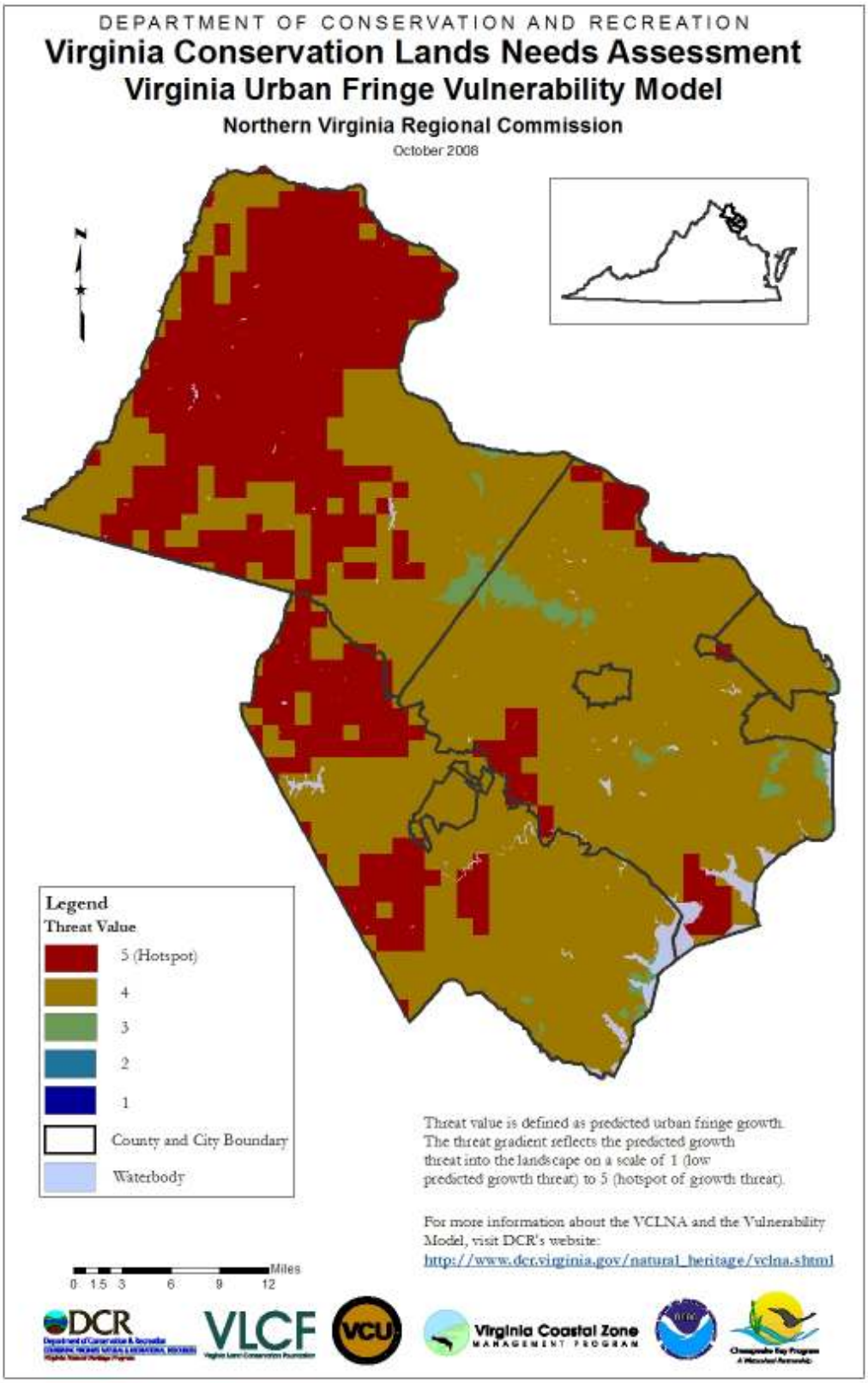


Figure 32. PDC 8 Northern Virginia Regional Commission Outside the Urban Fringe Vulnerability Model.

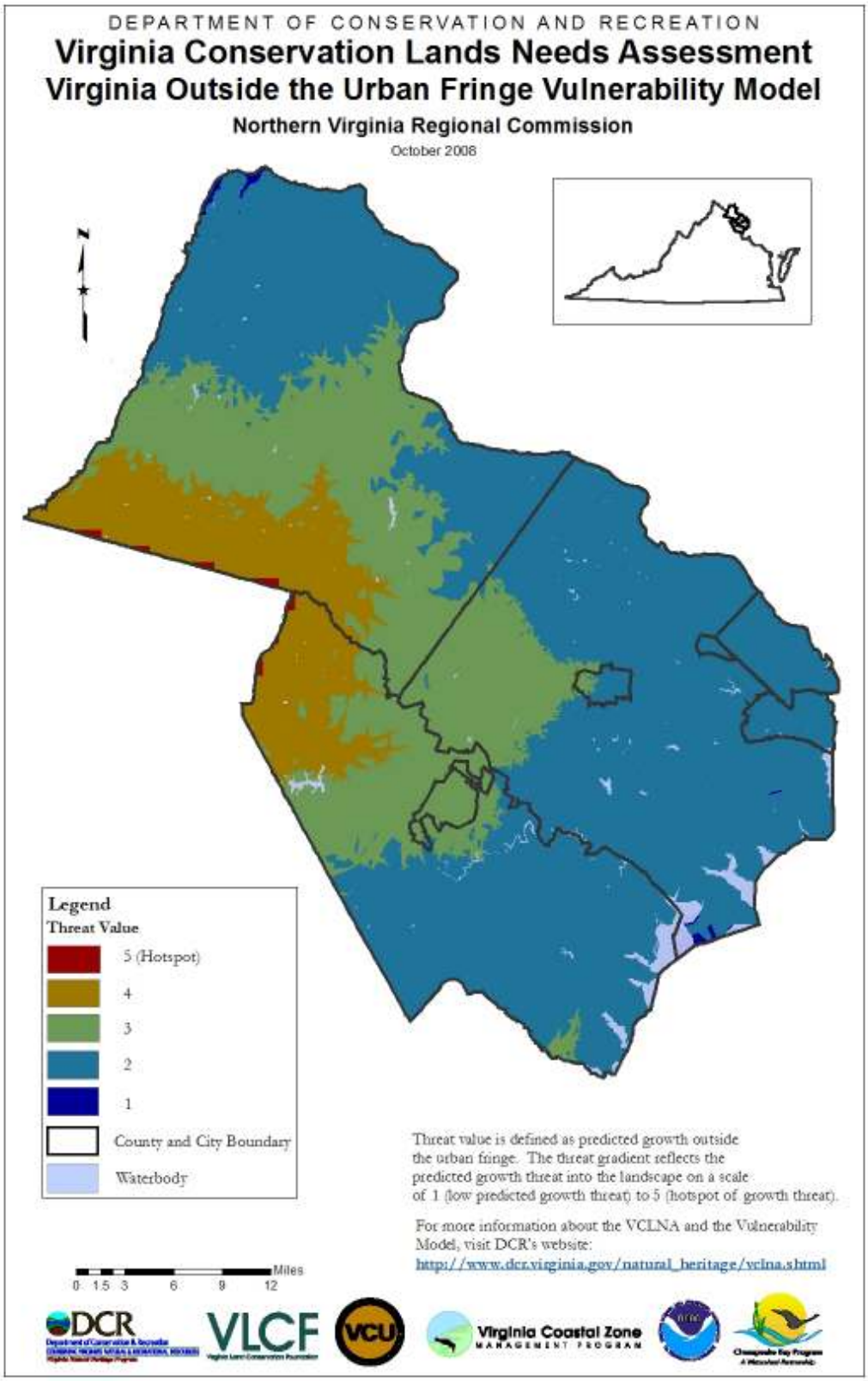


Figure 33. PDC 9 Rappahannock-Rapidan Regional Commission Vulnerability Model.

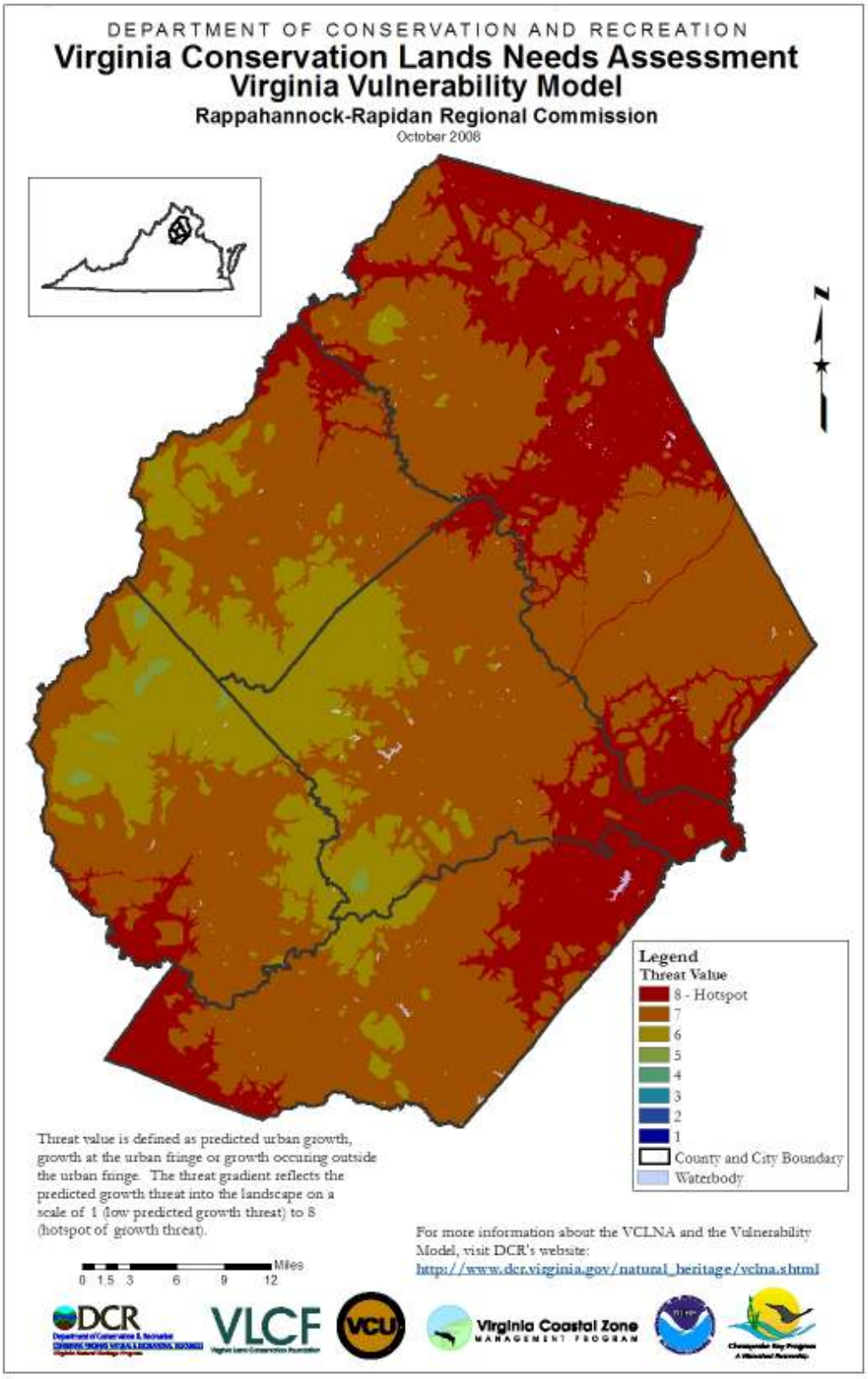


Figure 34. PDC 9 Rappahannock-Rapidan Regional Commission Urban Vulnerability Model.

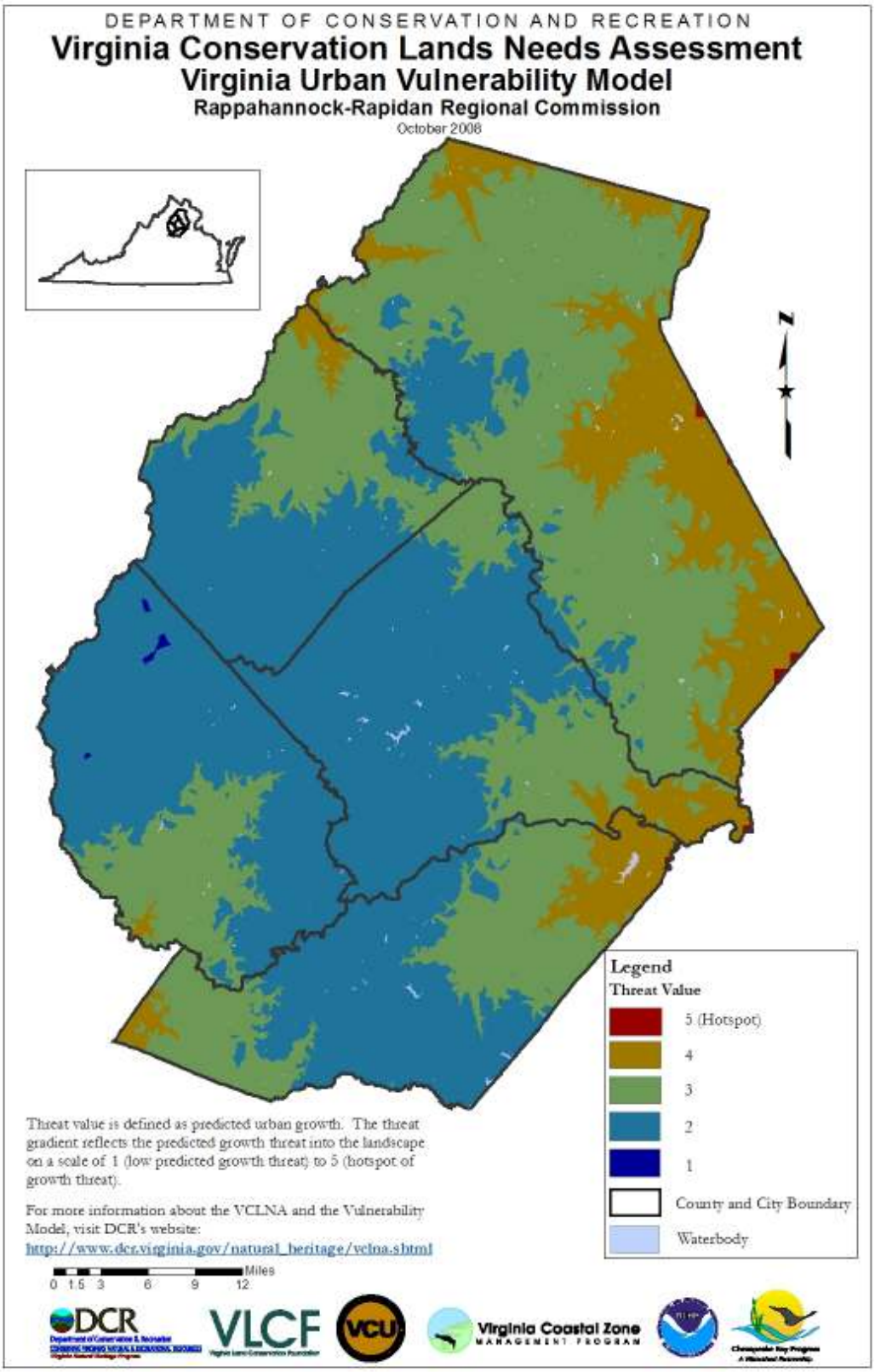


Figure 35. PDC 9 Rappahannock-Rapidan Regional Commission Urban Fringe Vulnerability Model.

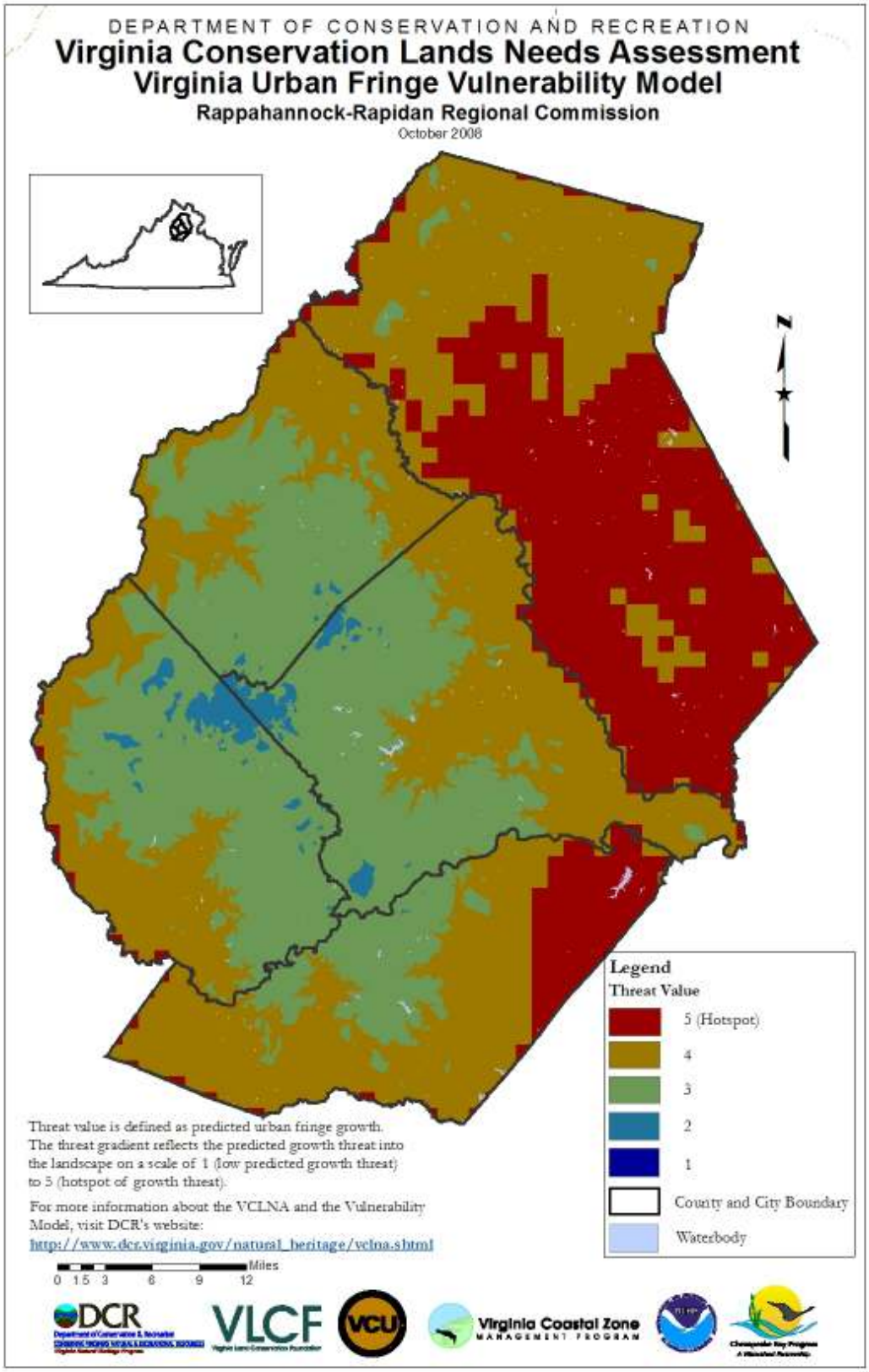


Figure 36. PDC 9 Rappahannock-Rapidan Regional Commission Outside the Urban Fringe Vulnerability Model.

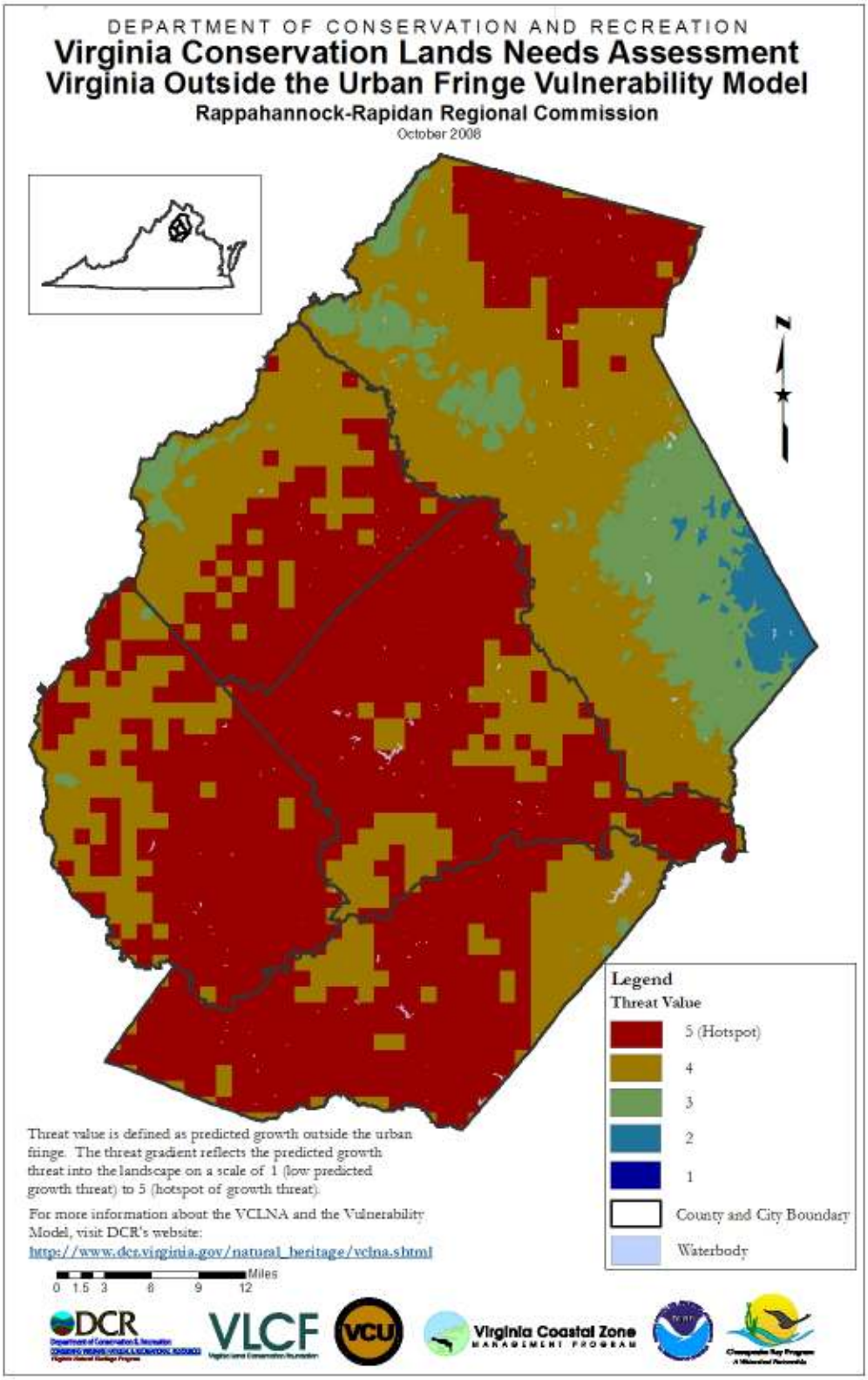


Figure 37. PDC 10 Thomas Jefferson Planning District Commission Vulnerability Model.

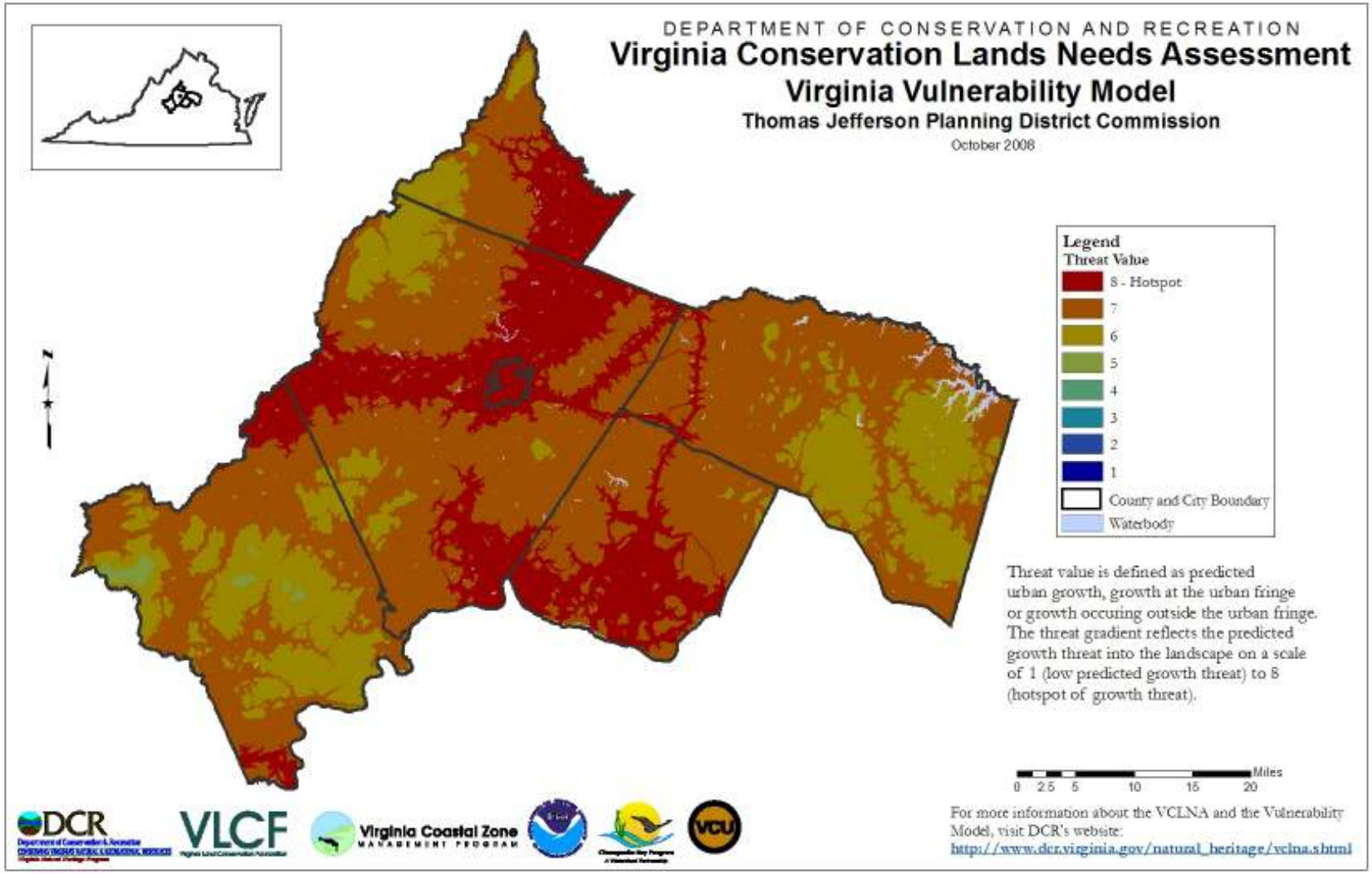


Figure 38. PDC 10 Thomas Jefferson Planning District Commission Urban Vulnerability Model.

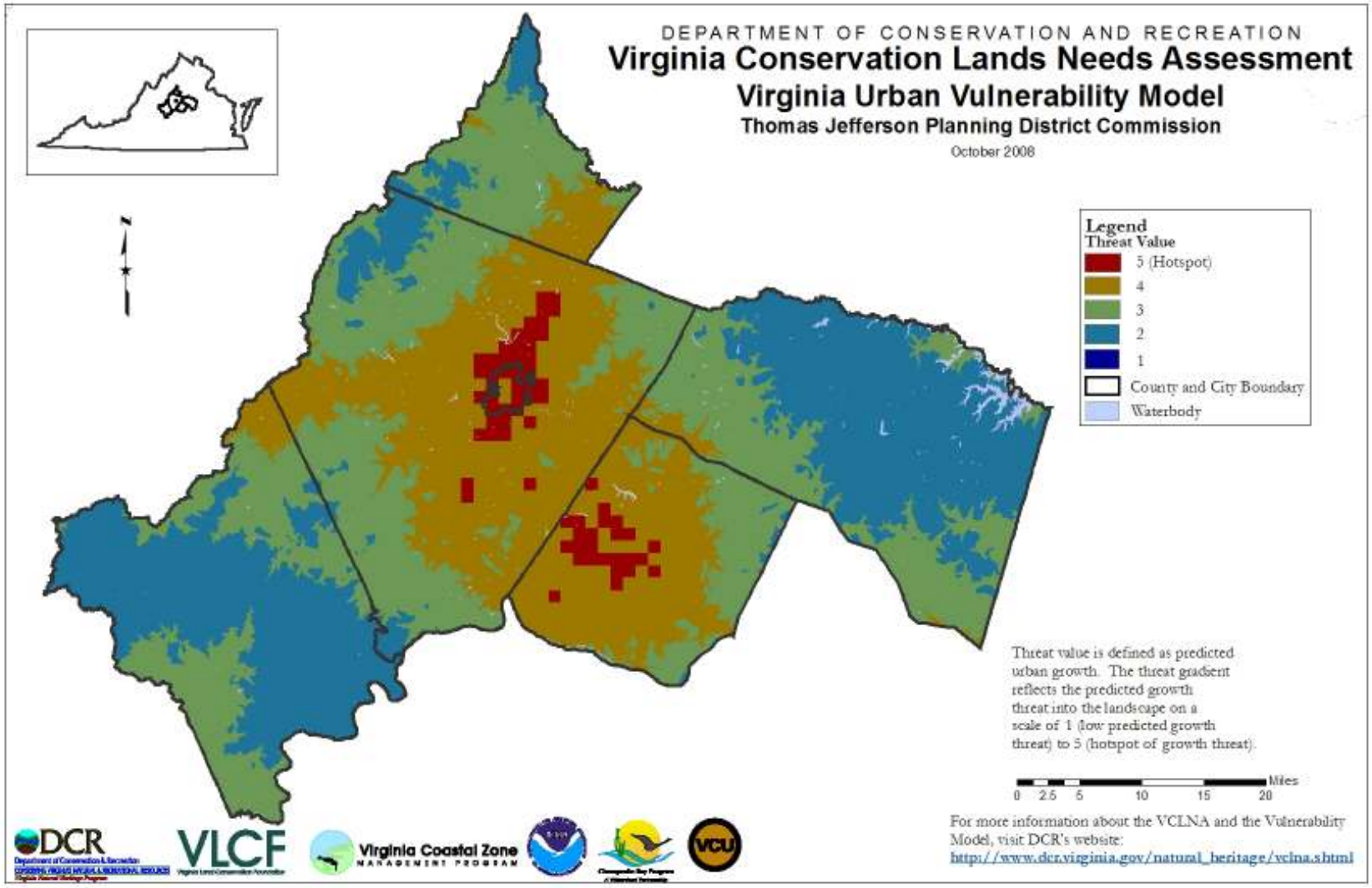


Figure 39. PDC 10 Thomas Jefferson Planning District Commission Urban Fringe Vulnerability Model.

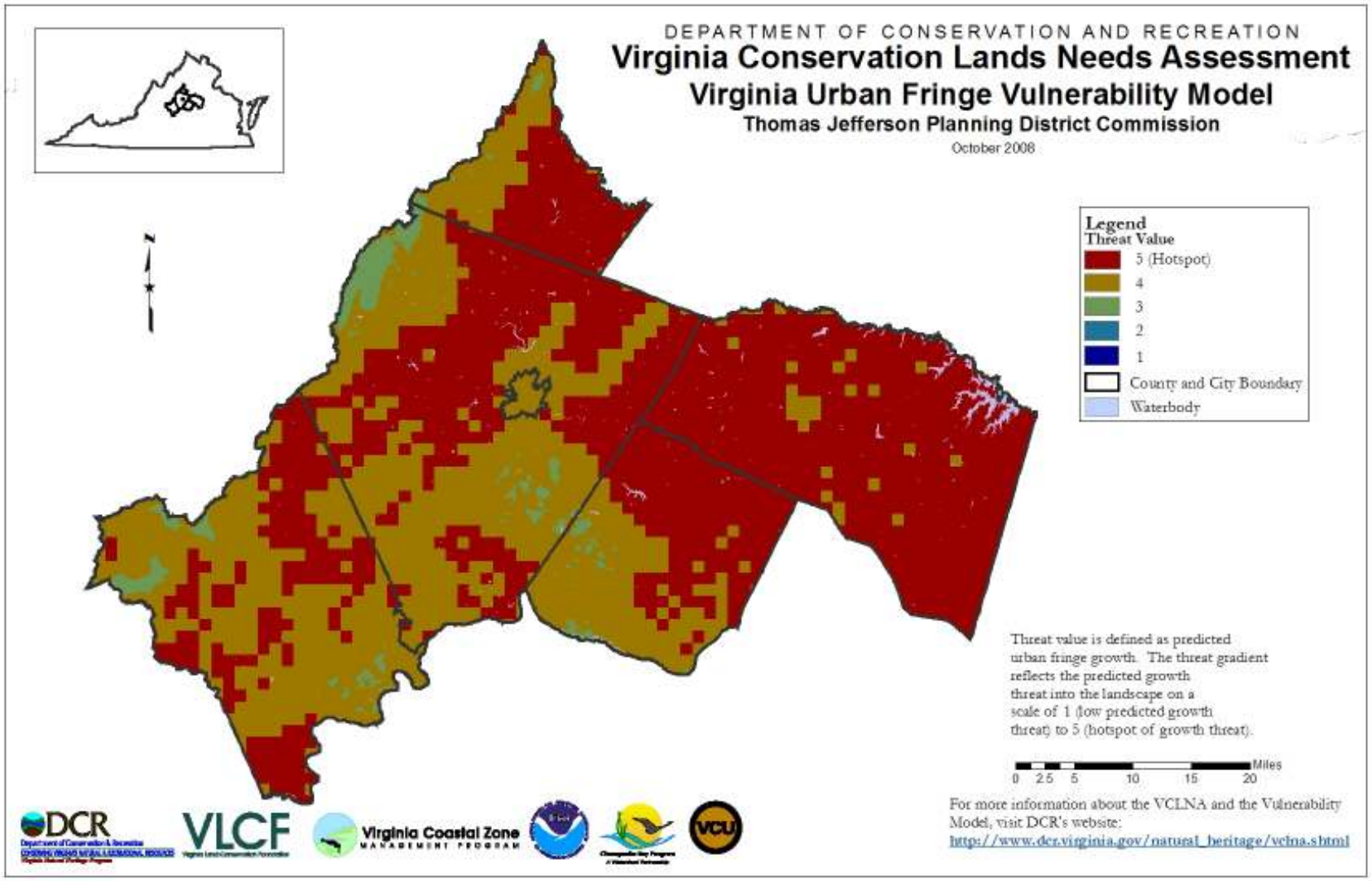


Figure 40. PDC 10 Thomas Jefferson Planning District Commission Outside the Urban Fringe Vulnerability Model.

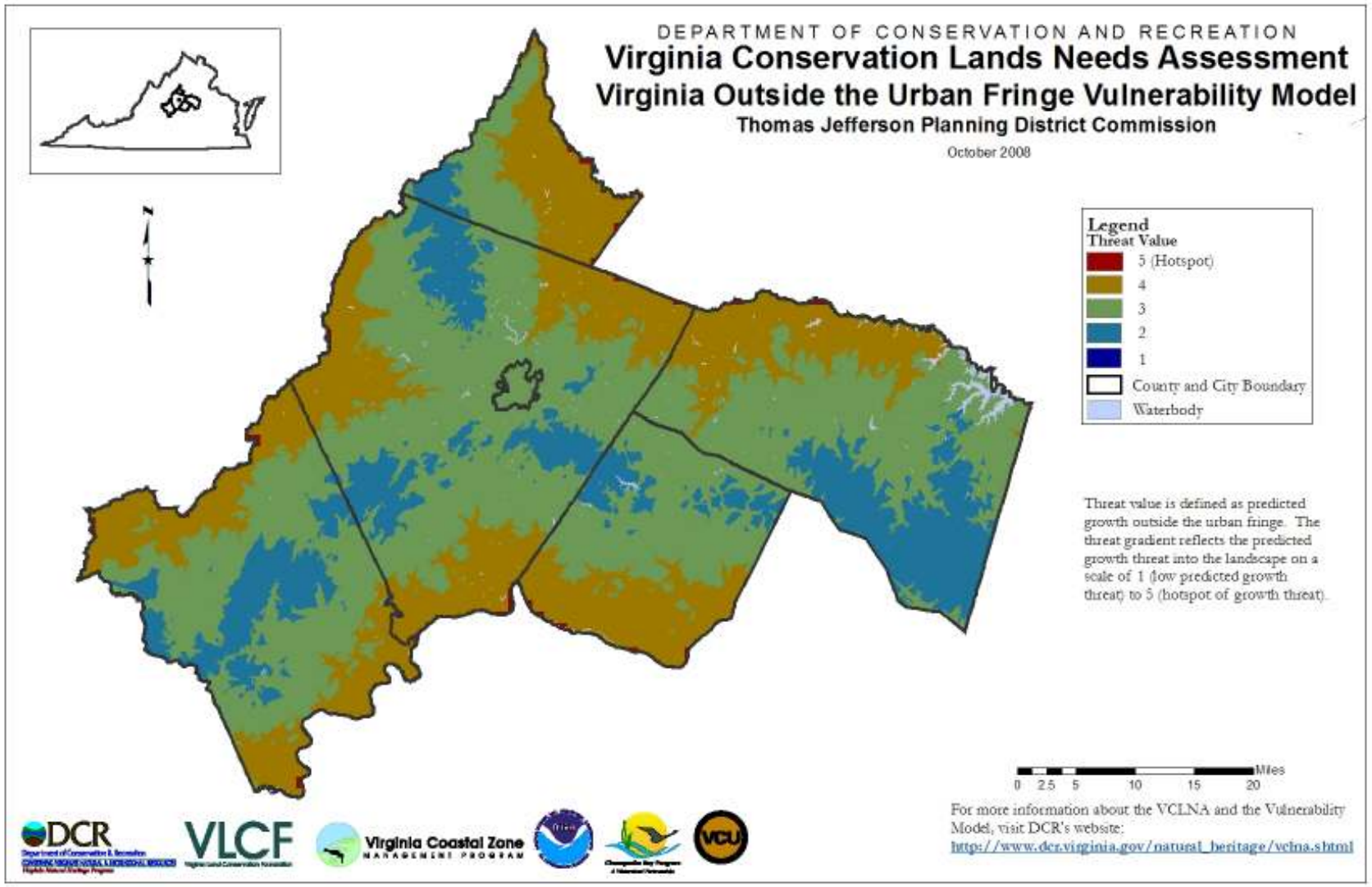


Figure 41. PDC 11 Region 2000 Local Government Council Vulnerability Model.

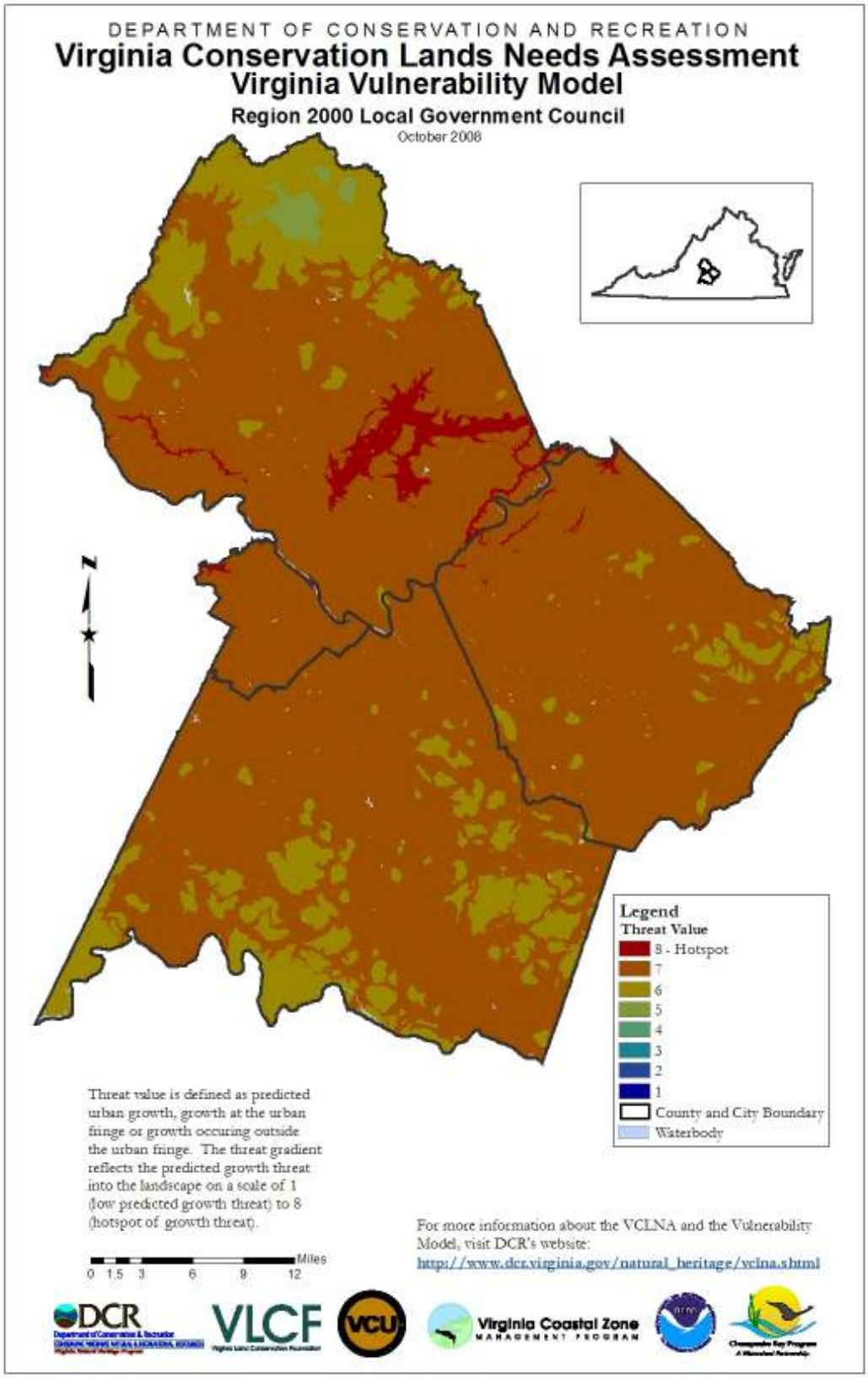


Figure 42. PDC 11 Region 2000 Local Government Council Urban Vulnerability Model.

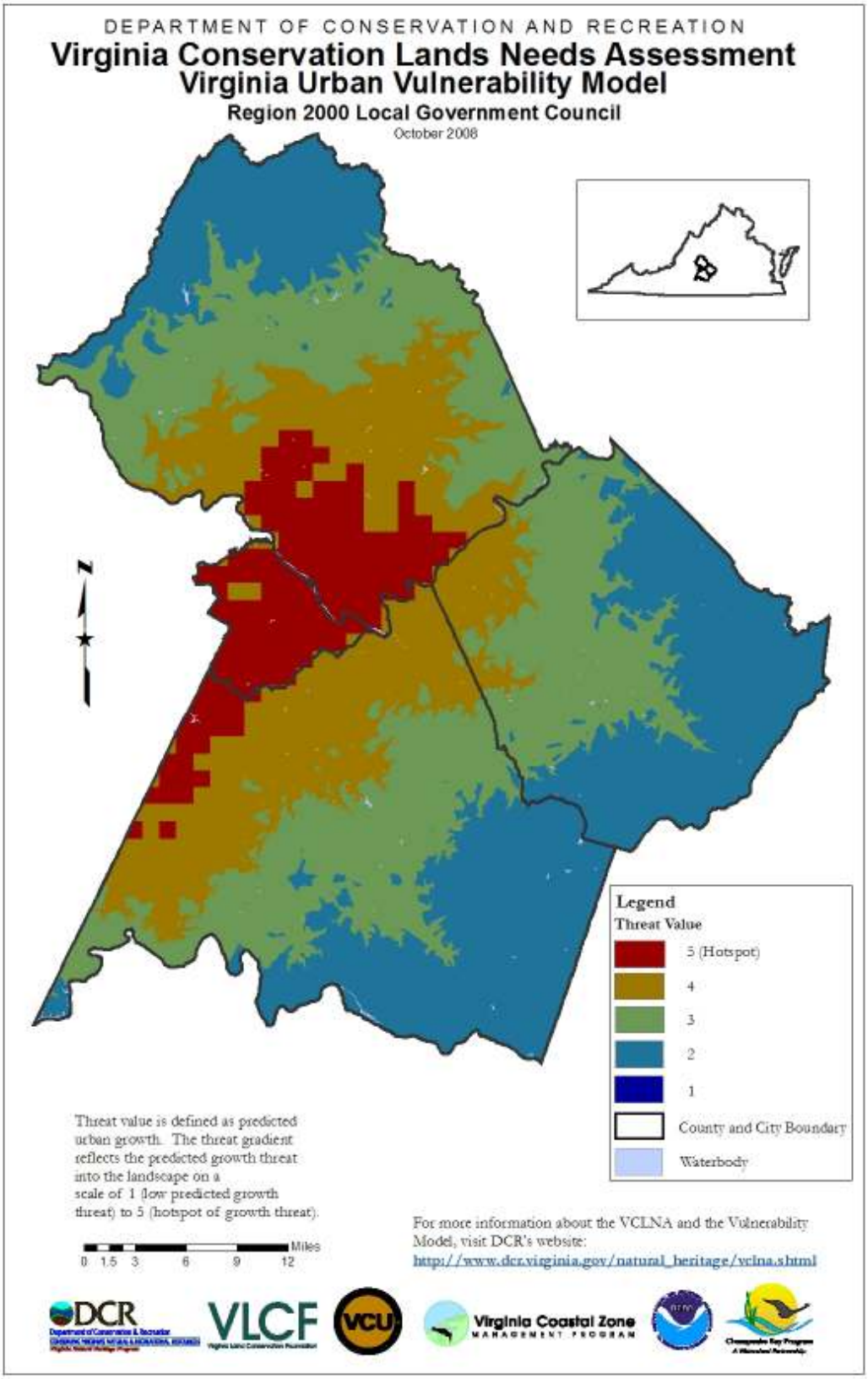


Figure 43. PDC 11 Region 2000 Local Government Council Urban Fringe Vulnerability Model.

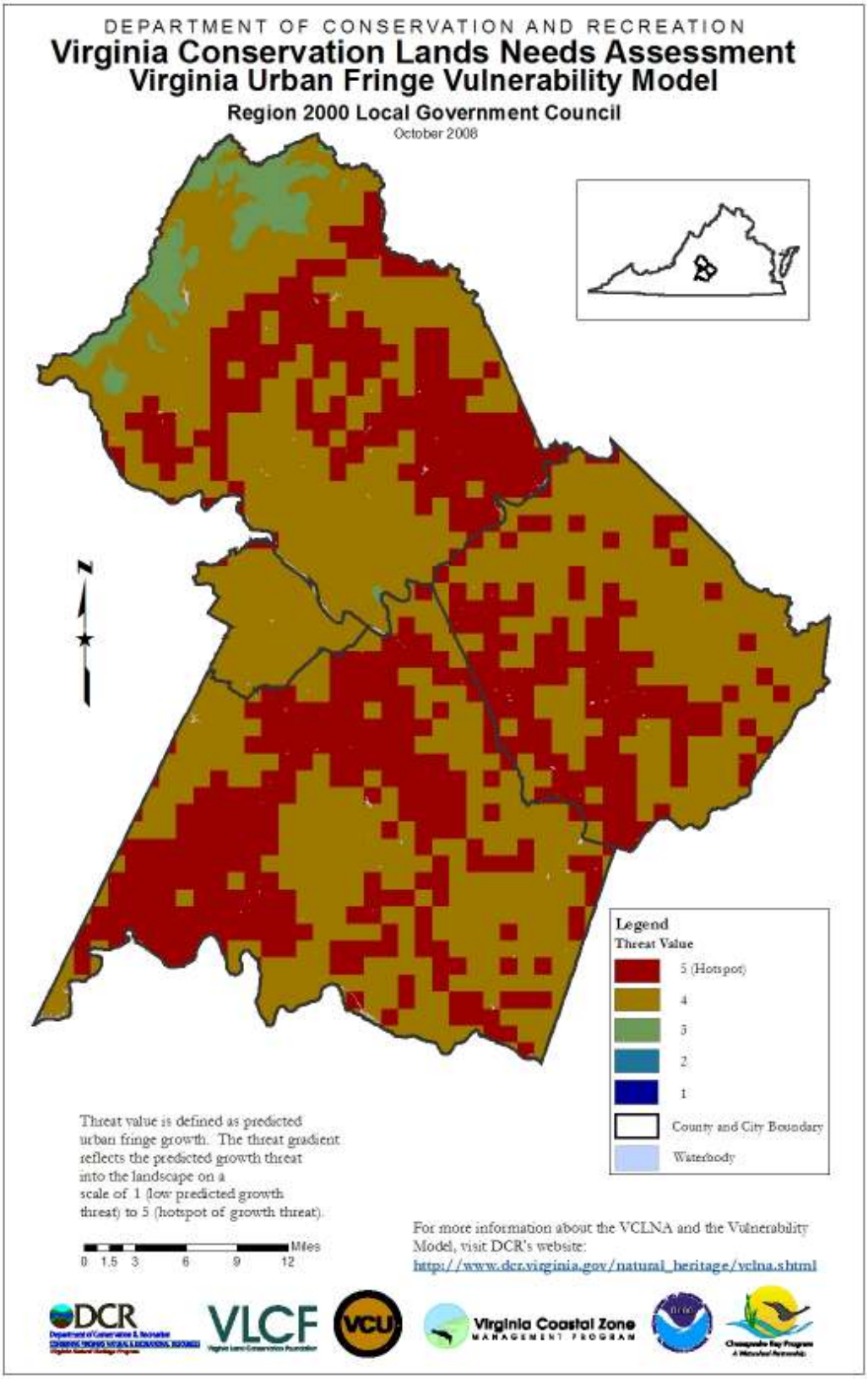


Figure 44. PDC 11 Region 2000 Local Government Council Outside the Urban Fringe Vulnerability Model.

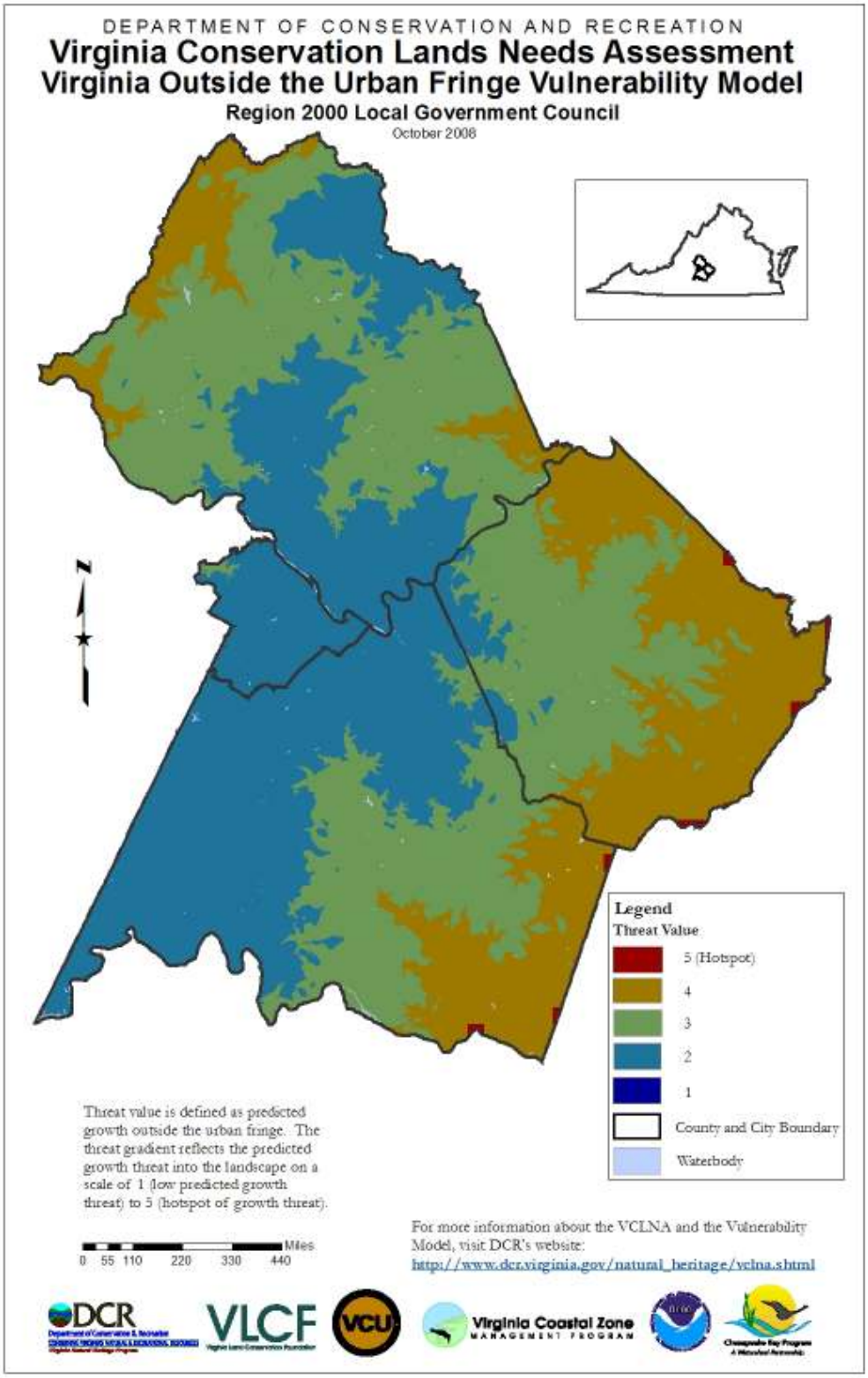


Figure 45. PDC 12 West Piedmont Planning District Commission Vulnerability Model.

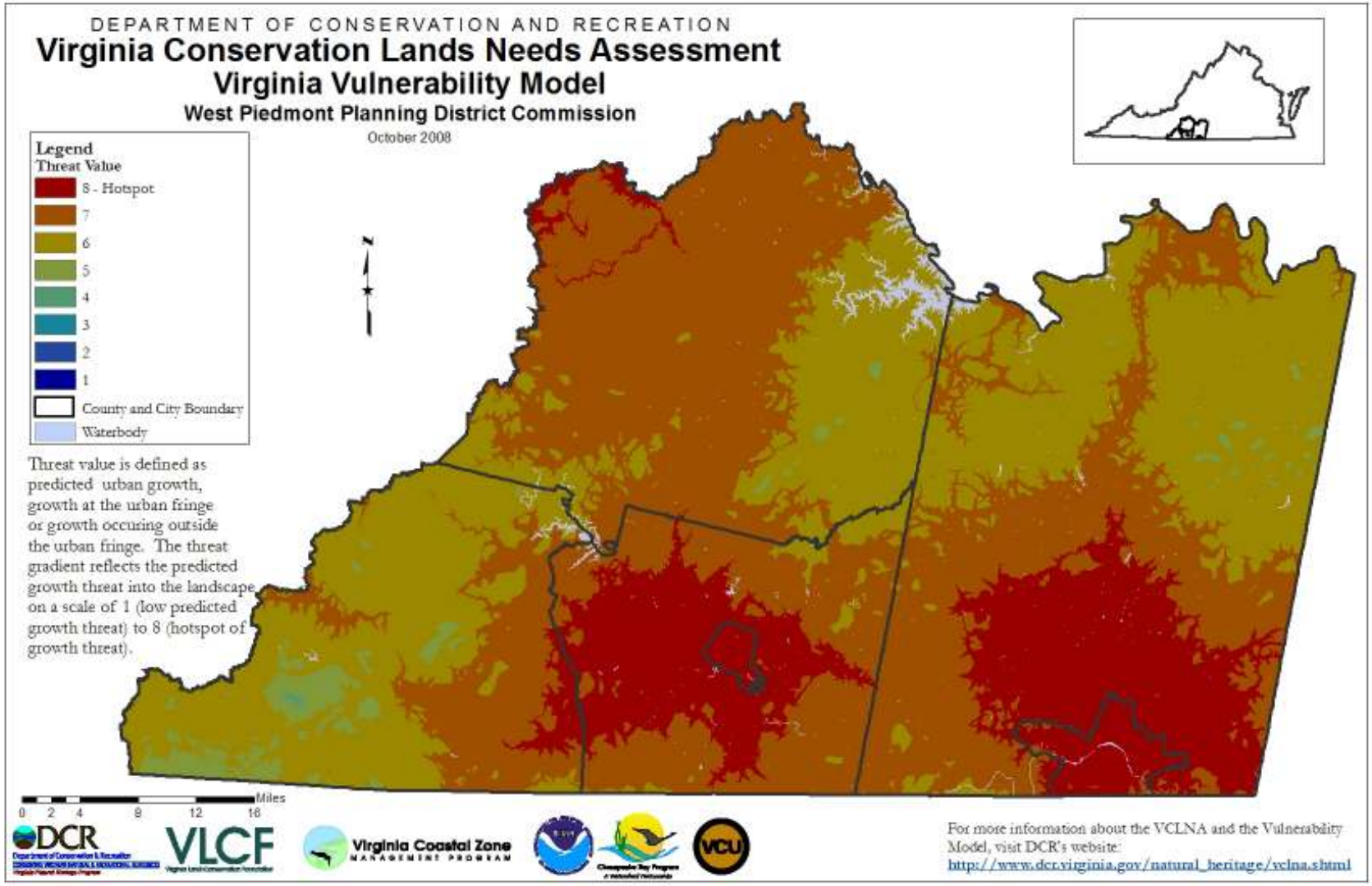


Figure 46. PDC 12 West Piedmont Planning District Commission Urban Vulnerability Model.

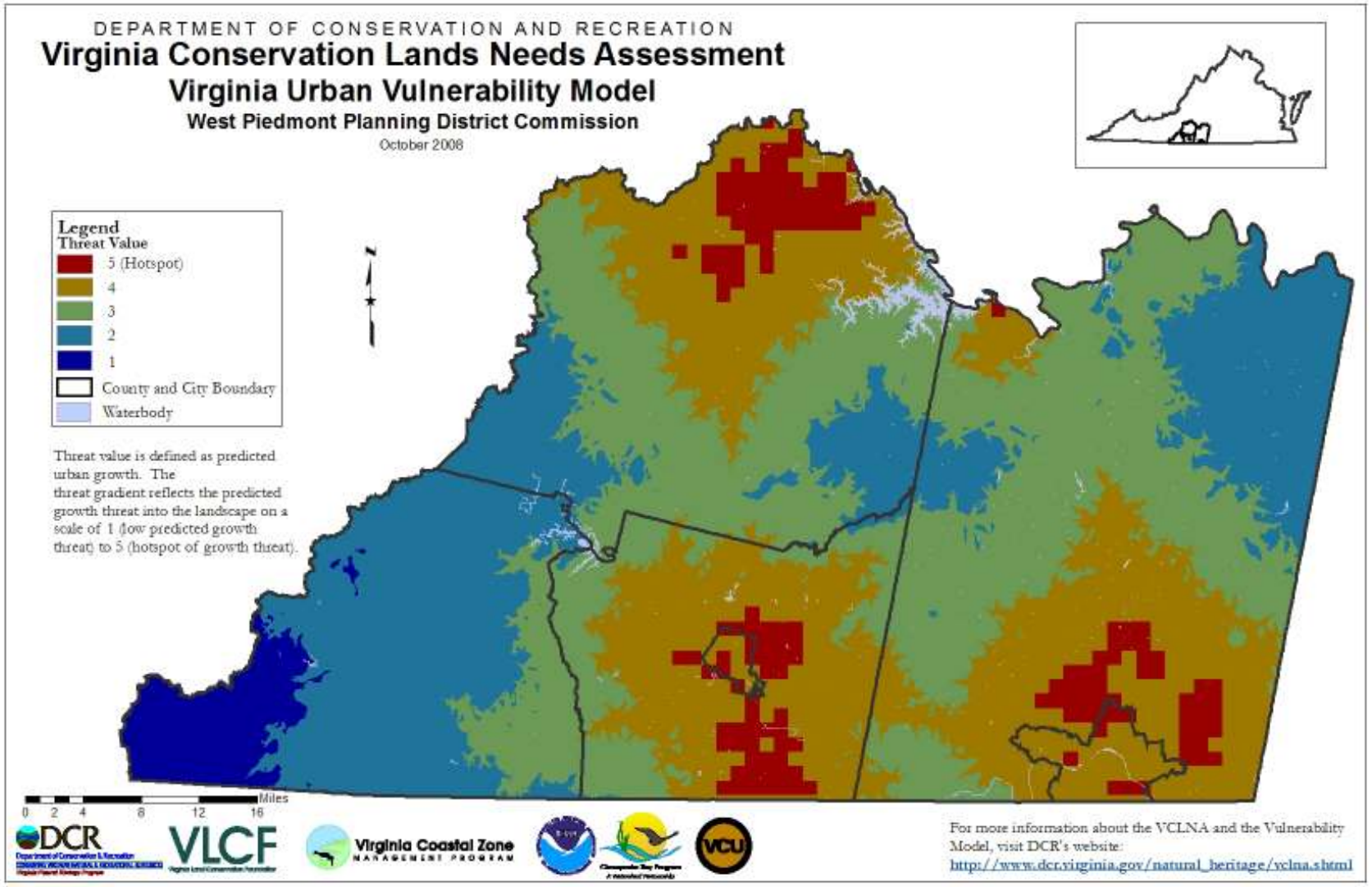


Figure 47. PDC 12 West Piedmont Planning District Commission Urban Fringe Vulnerability Model.

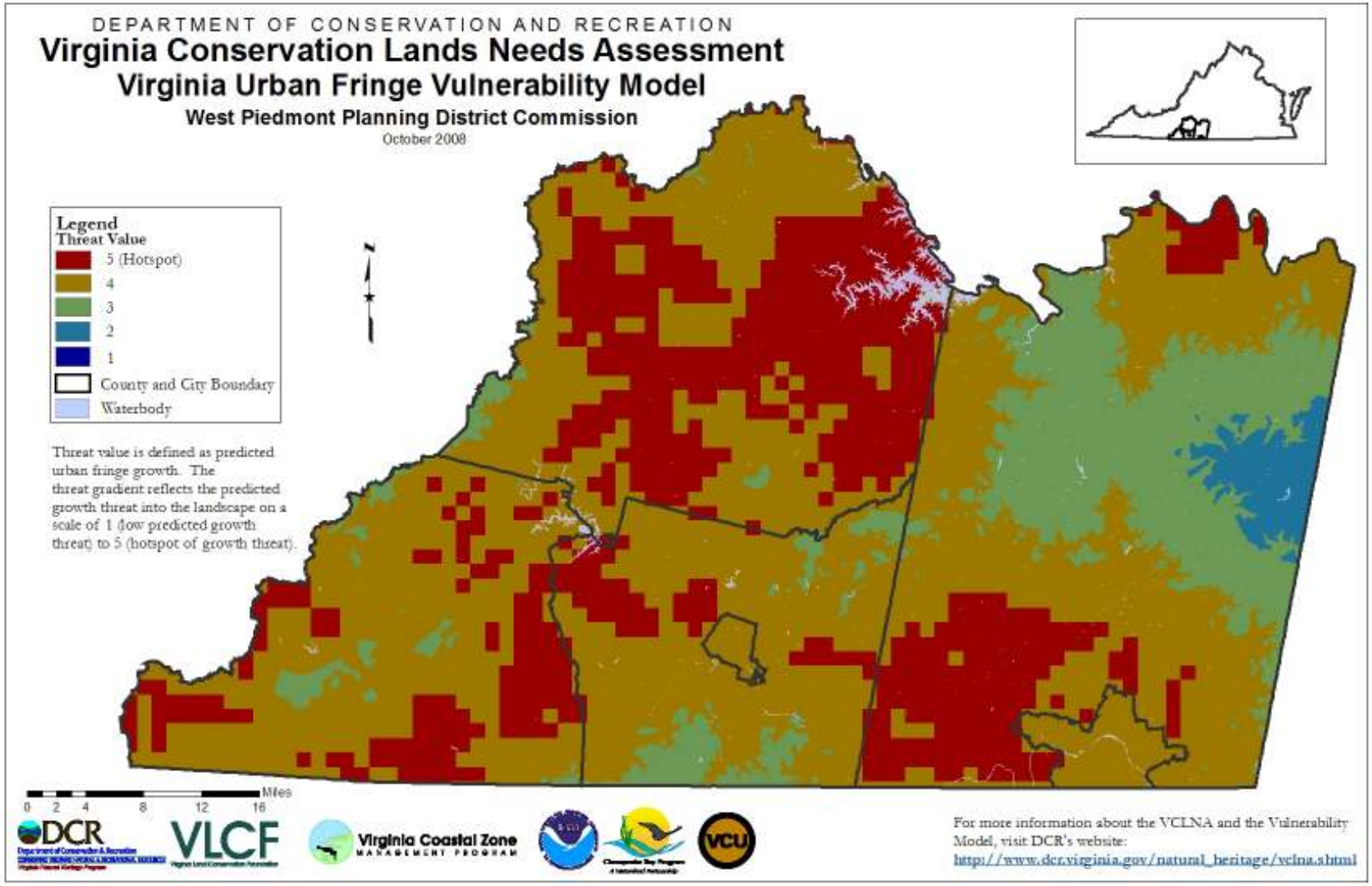


Figure 48. PDC 12 West Piedmont Planning District Commission Outside the Urban Fringe Vulnerability Model.

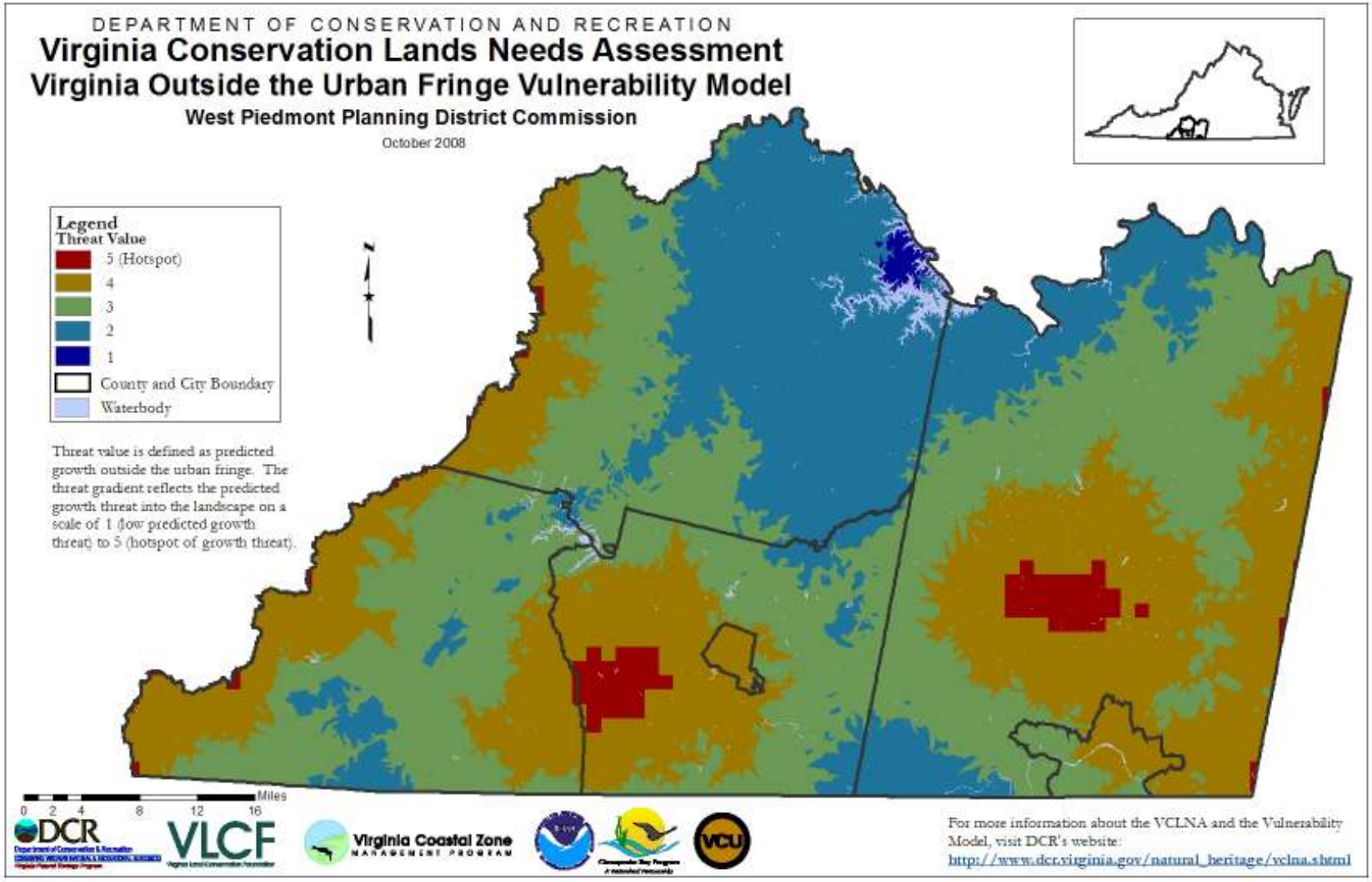


Figure 49. PDC 13 Southside Planning District Commission Vulnerability Model.

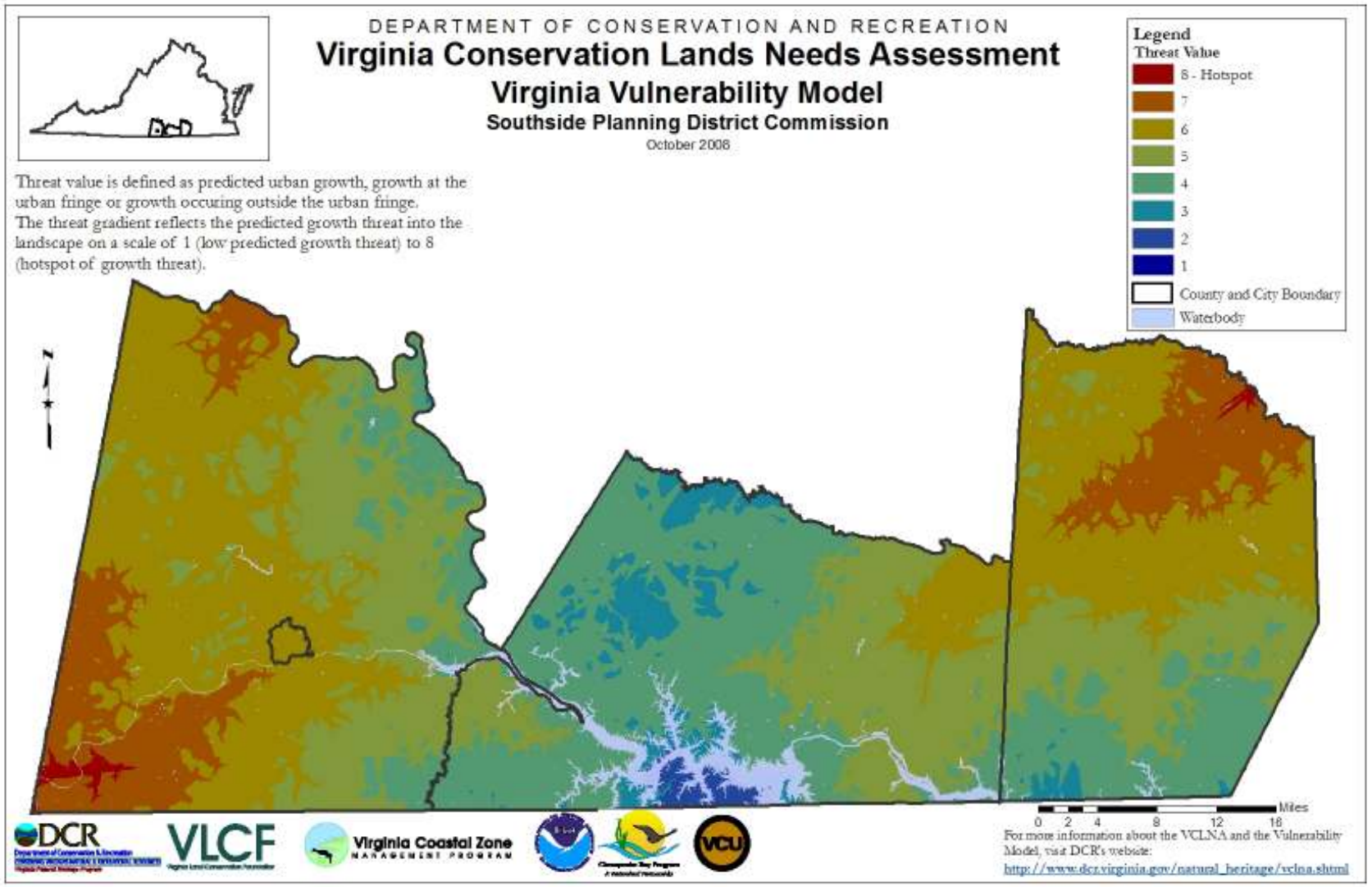


Figure 50. PDC 13 Southside Planning District Commission Urban Vulnerability Model.

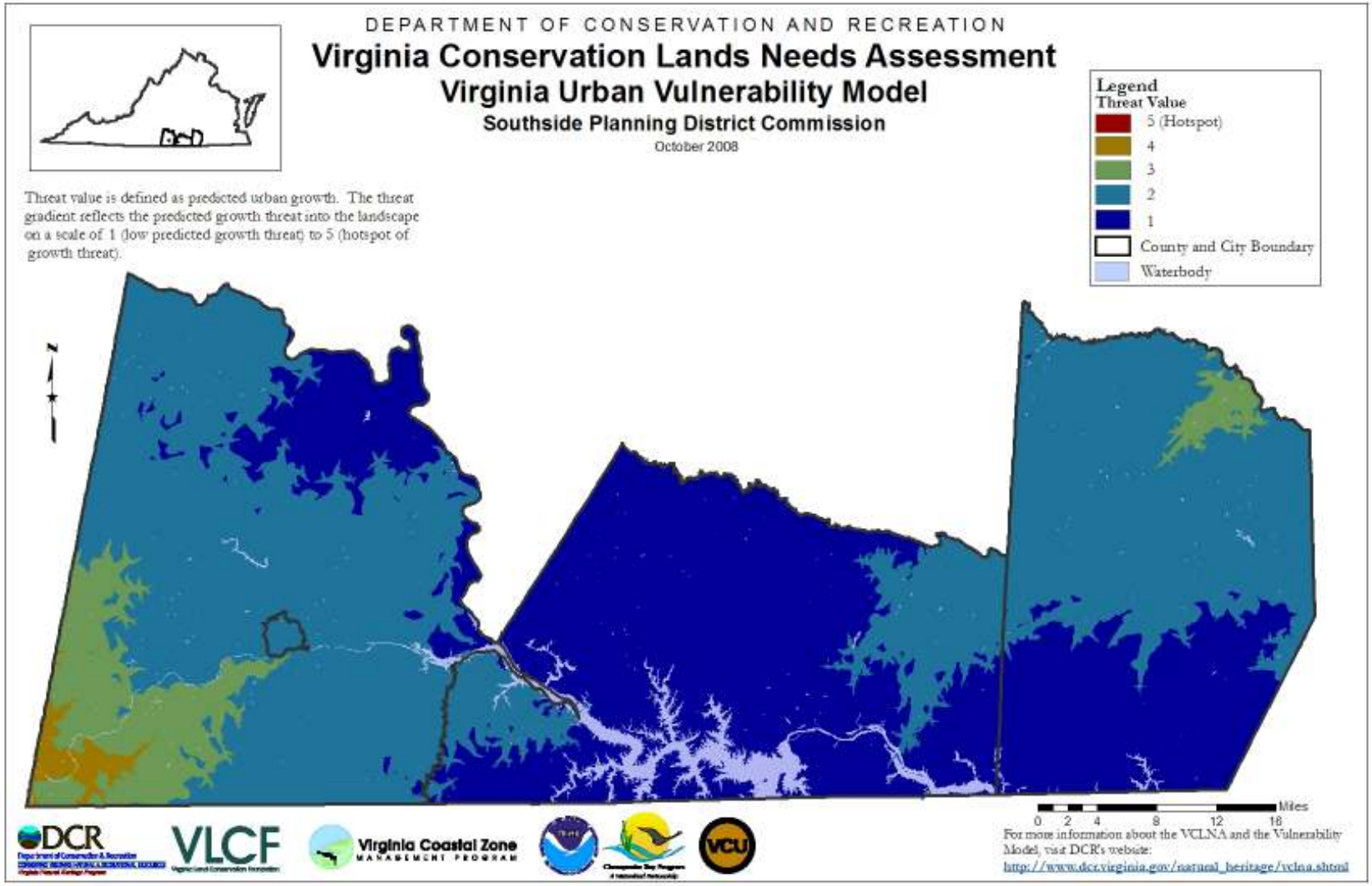


Figure 51. PDC 13 Southside Planning District Commission Urban Fringe Vulnerability Model.

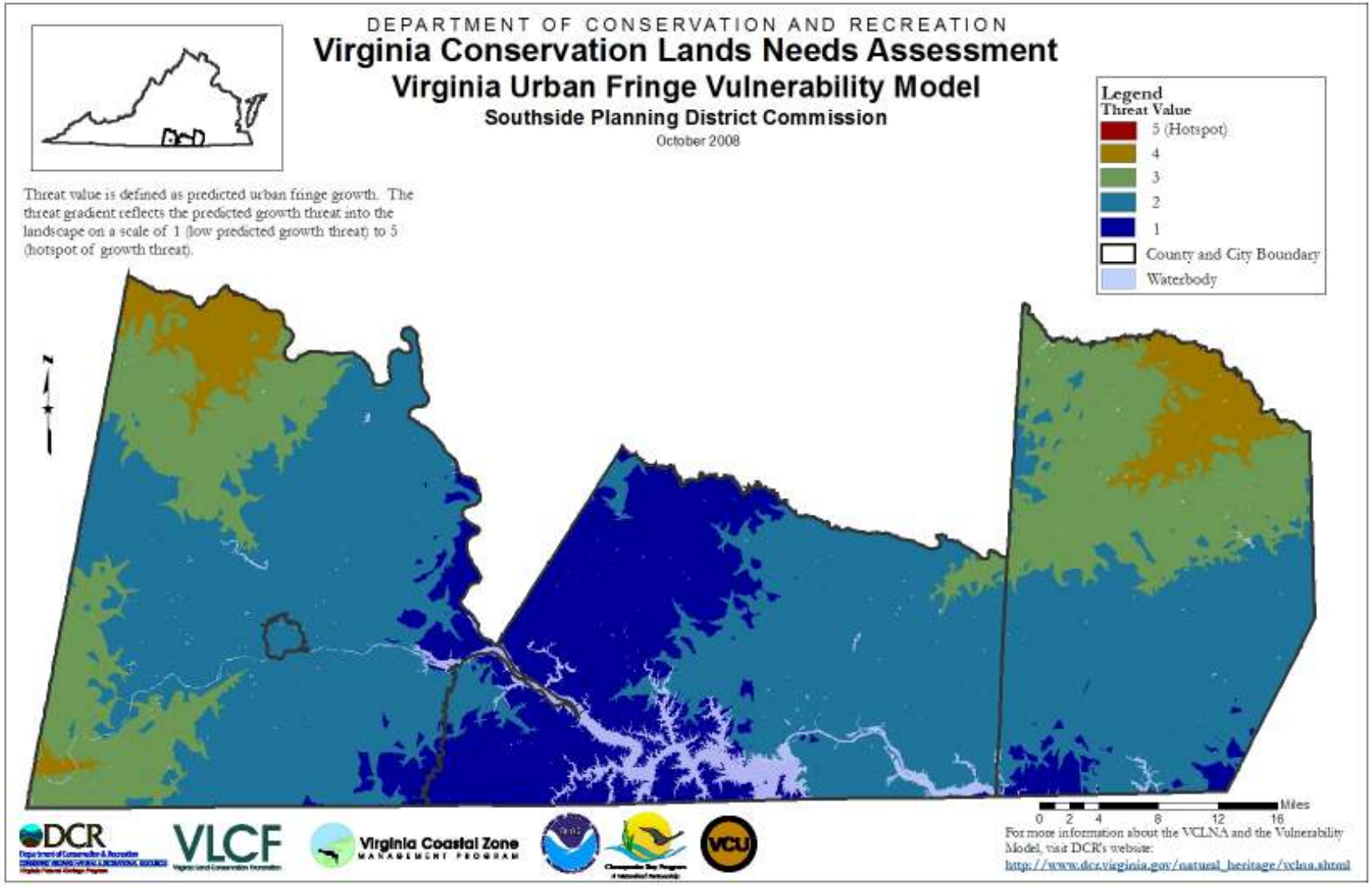


Figure 52. PDC 13 Southside Planning District Commission Outside the Urban Fringe Vulnerability Model.

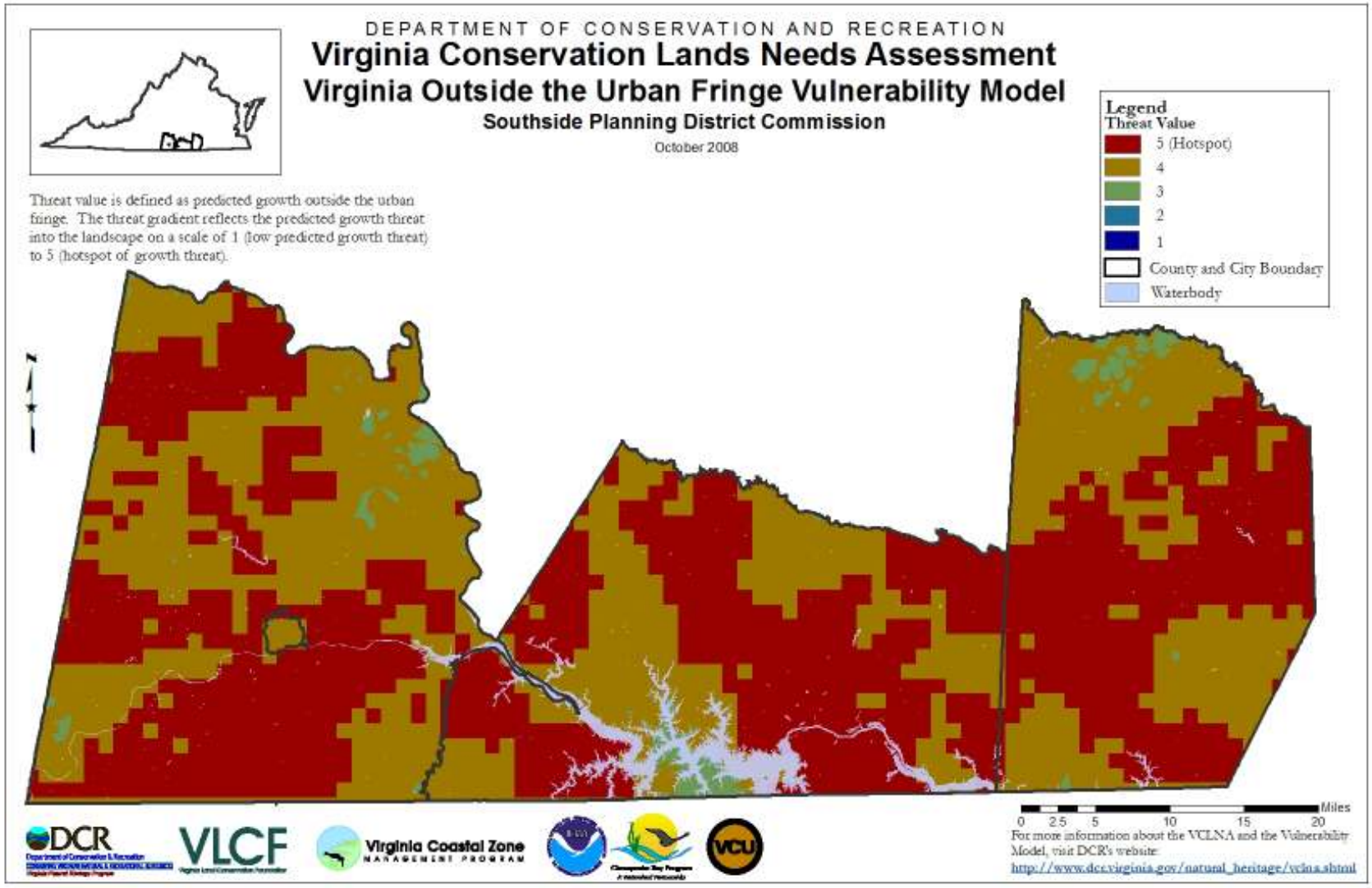


Figure 53. PDC 14 Commonwealth Regional Council Vulnerability Model.

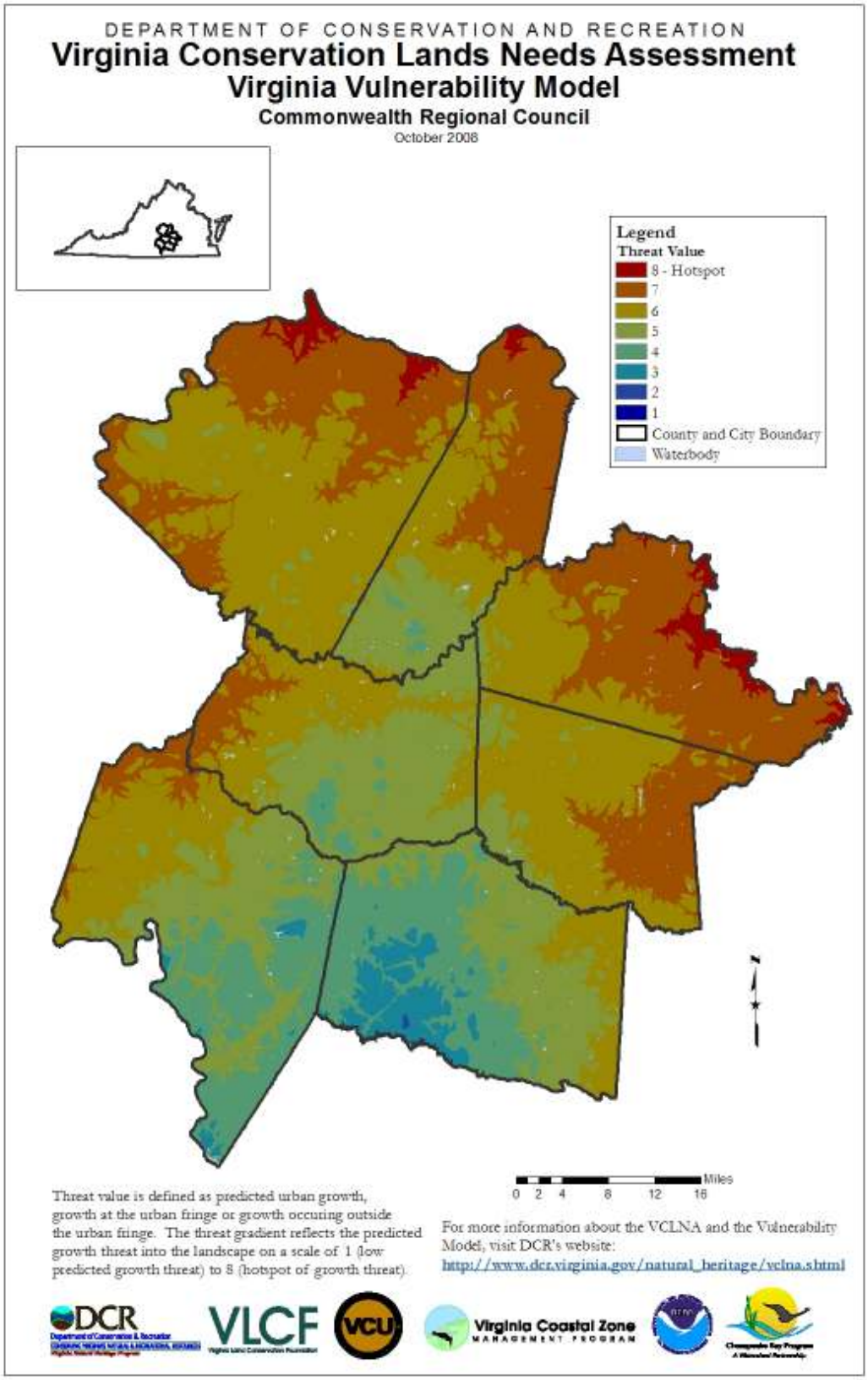


Figure 54. DC 14 Commonwealth Regional Council Urban Vulnerability Model.

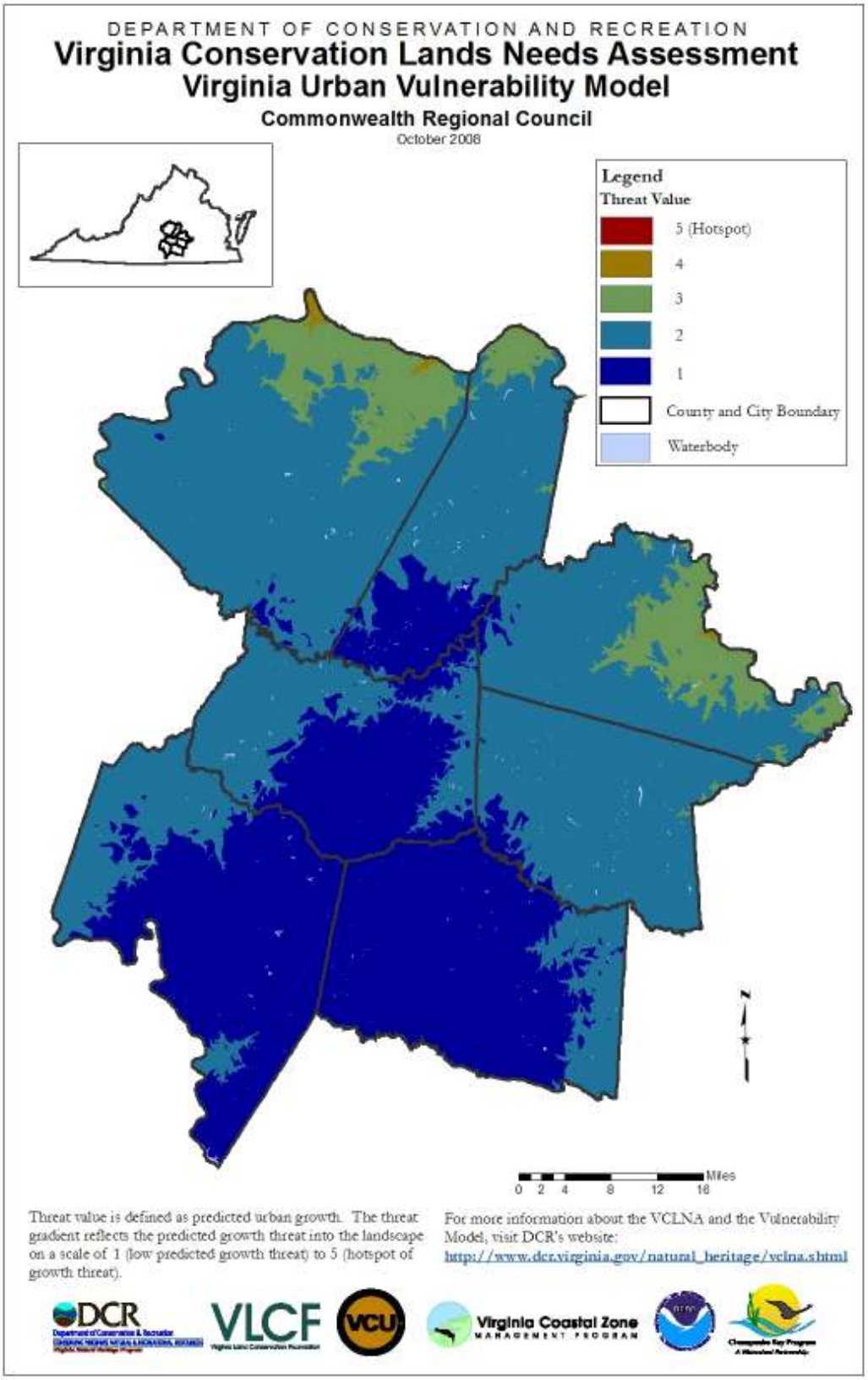


Figure 55. PDC 14 Commonwealth Regional Council Urban Fringe Vulnerability Model.

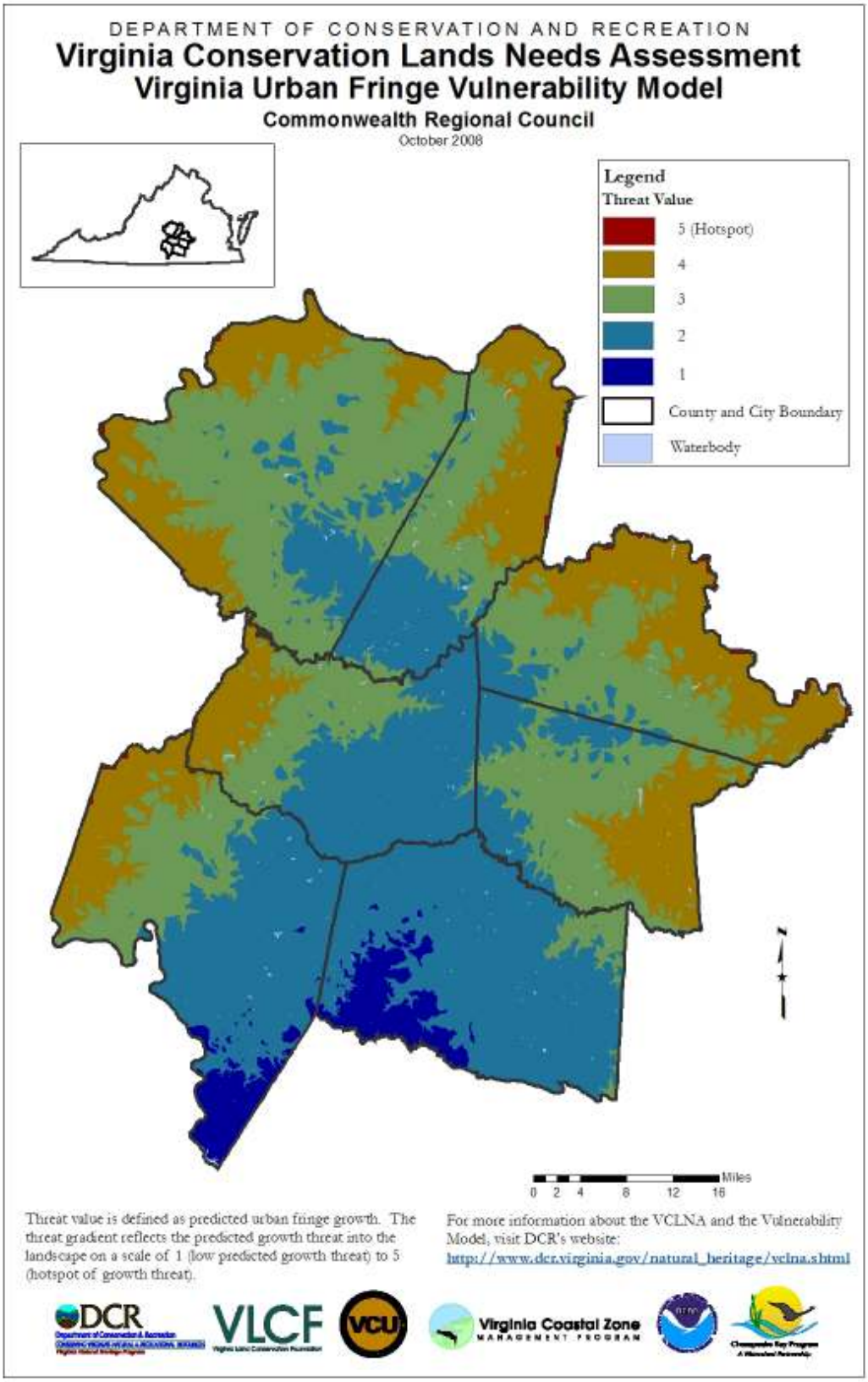


Figure 56. PDC 14 Commonwealth Regional Council Growth Outside the Urban Fringe Vulnerability Model.

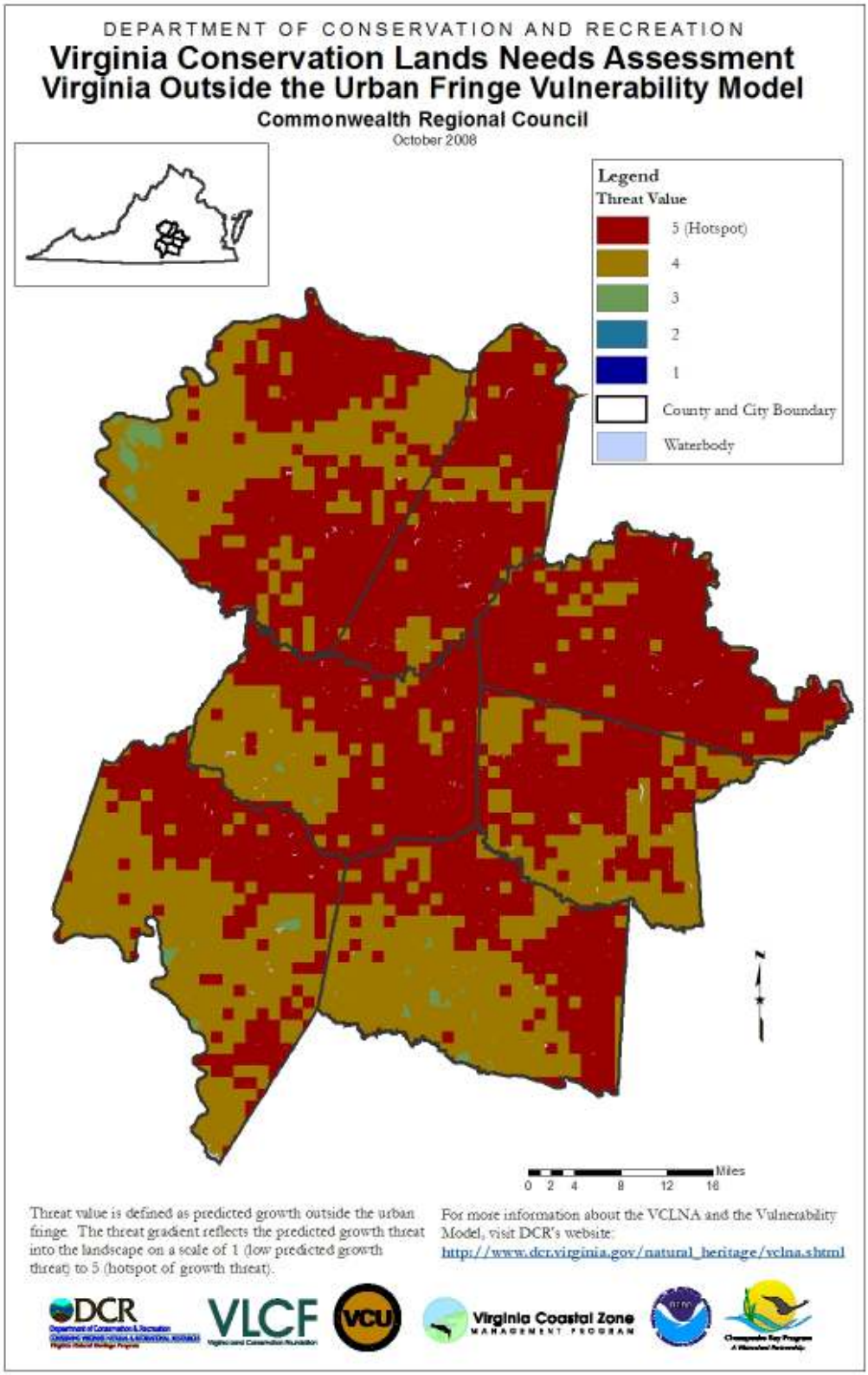


Figure 57. PDC 15 Richmond Regional Vulnerability Model.

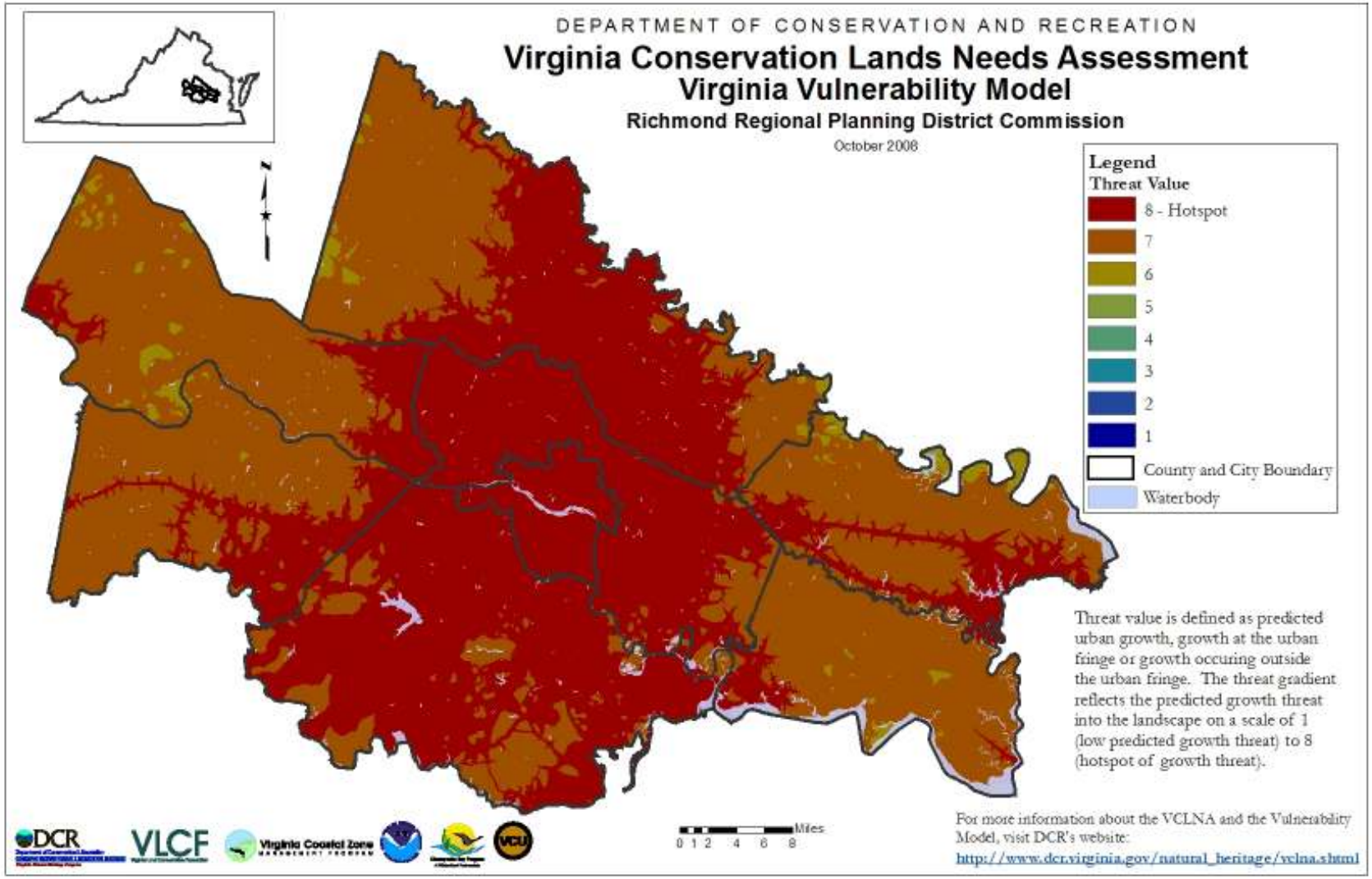


Figure 58. PDC 15 Richmond Regional Urban Vulnerability Model.

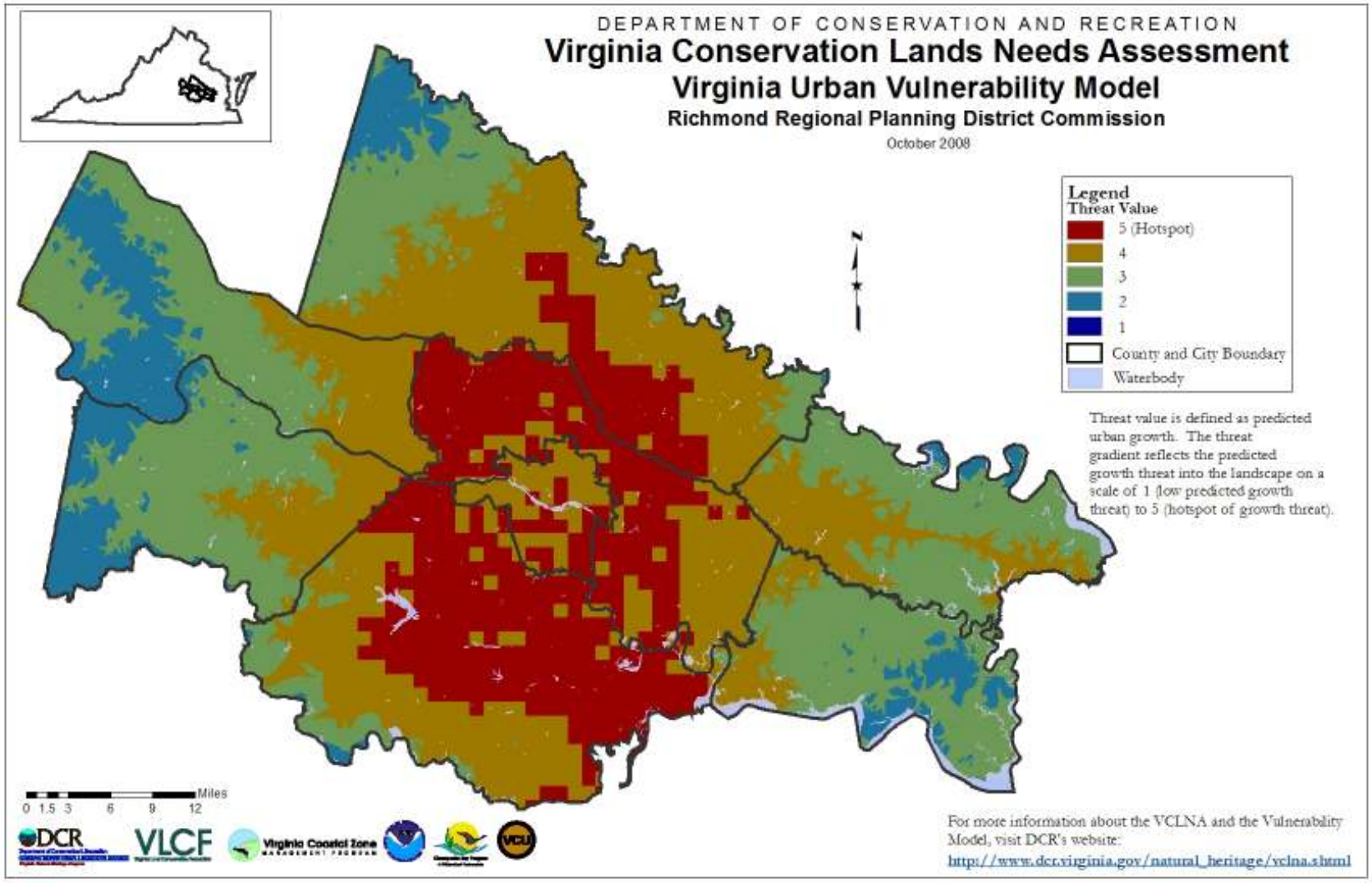


Figure 59. PDC 15 Richmond Regional Urban Fringe Vulnerability Model.

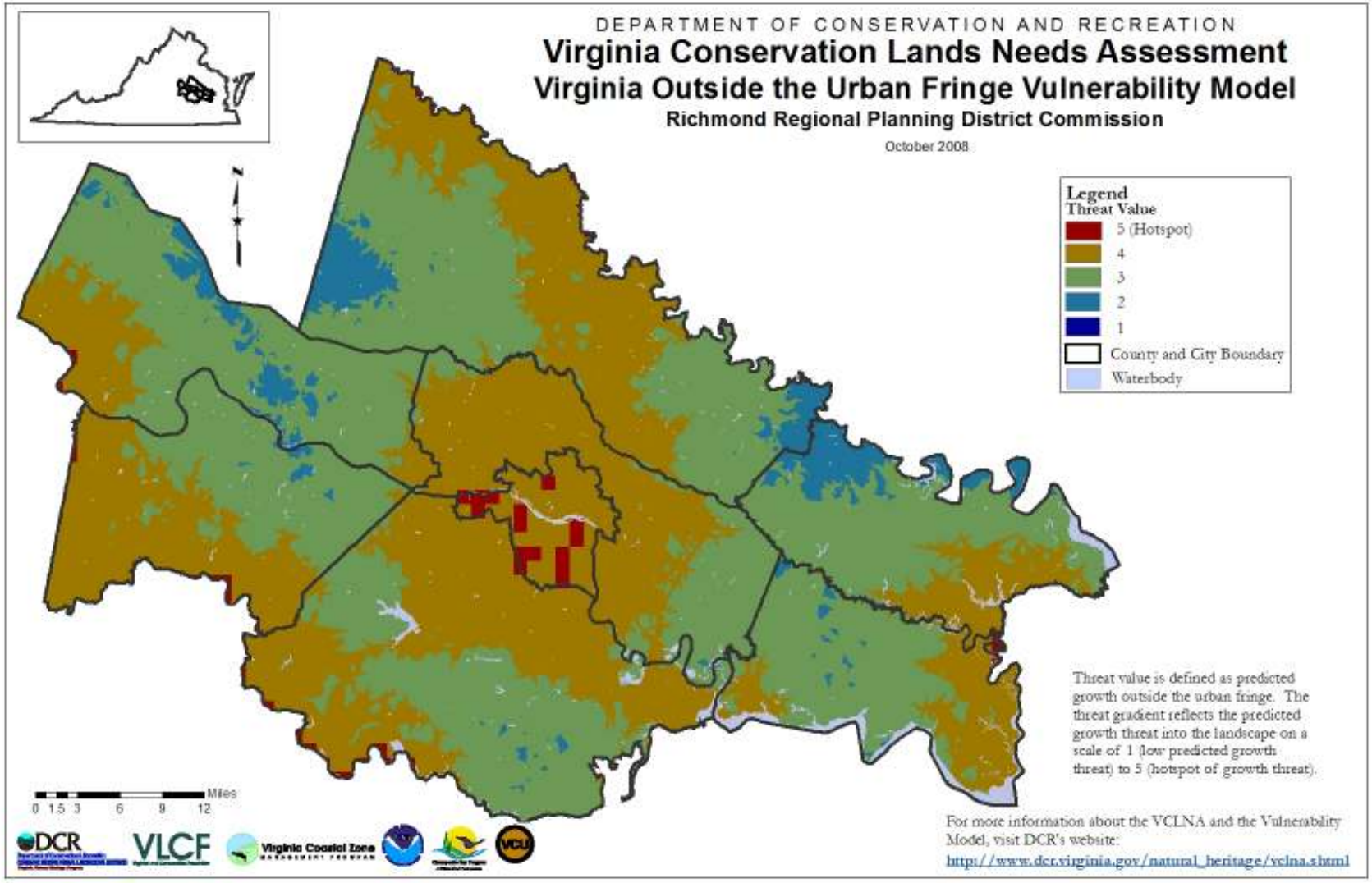


Figure 60. PDC 15 Richmond Regional Outside the Urban Fringe Vulnerability Model.

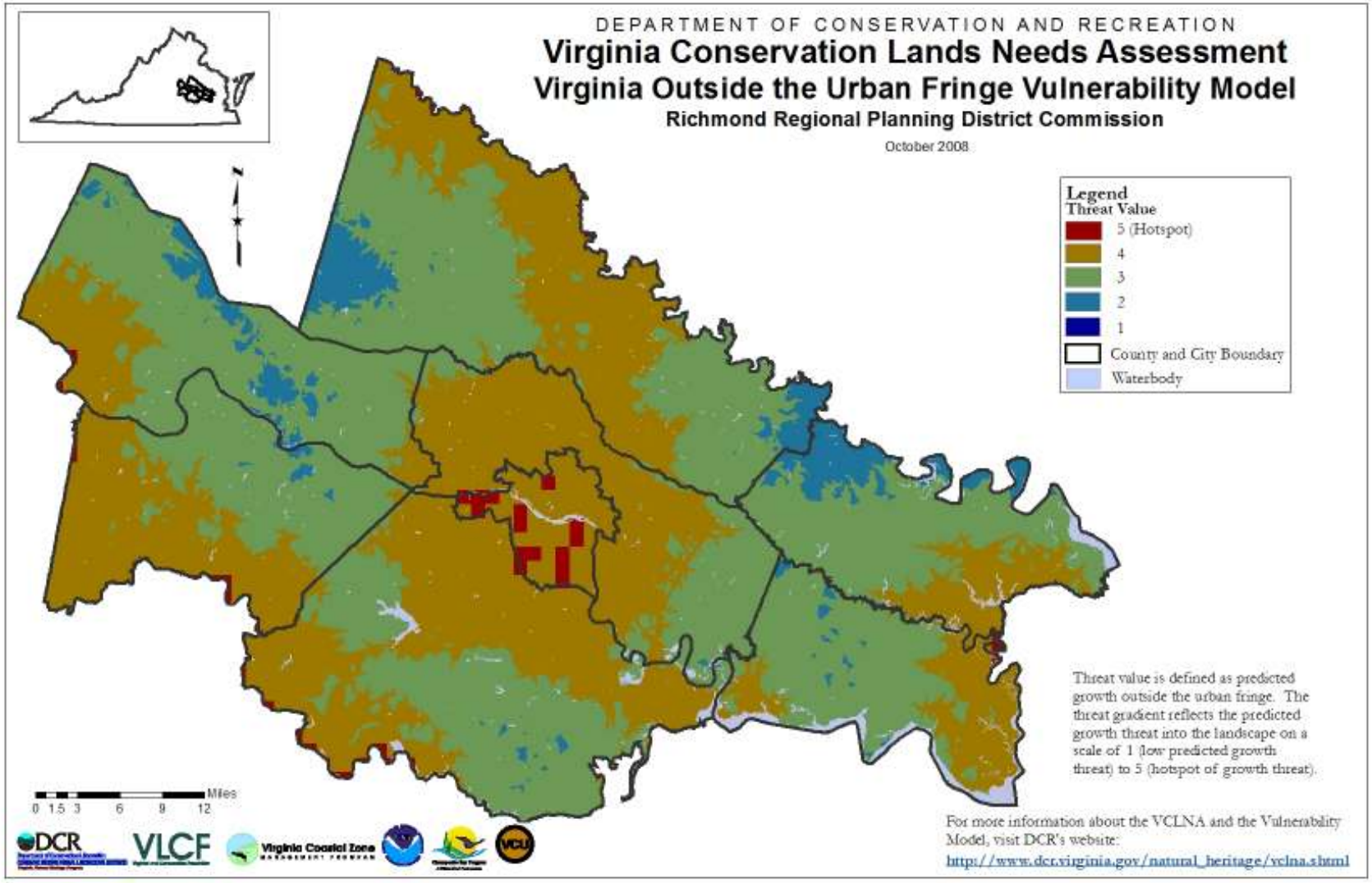


Figure 61. PDC 16 George Washington Regional Commission Vulnerability Model.

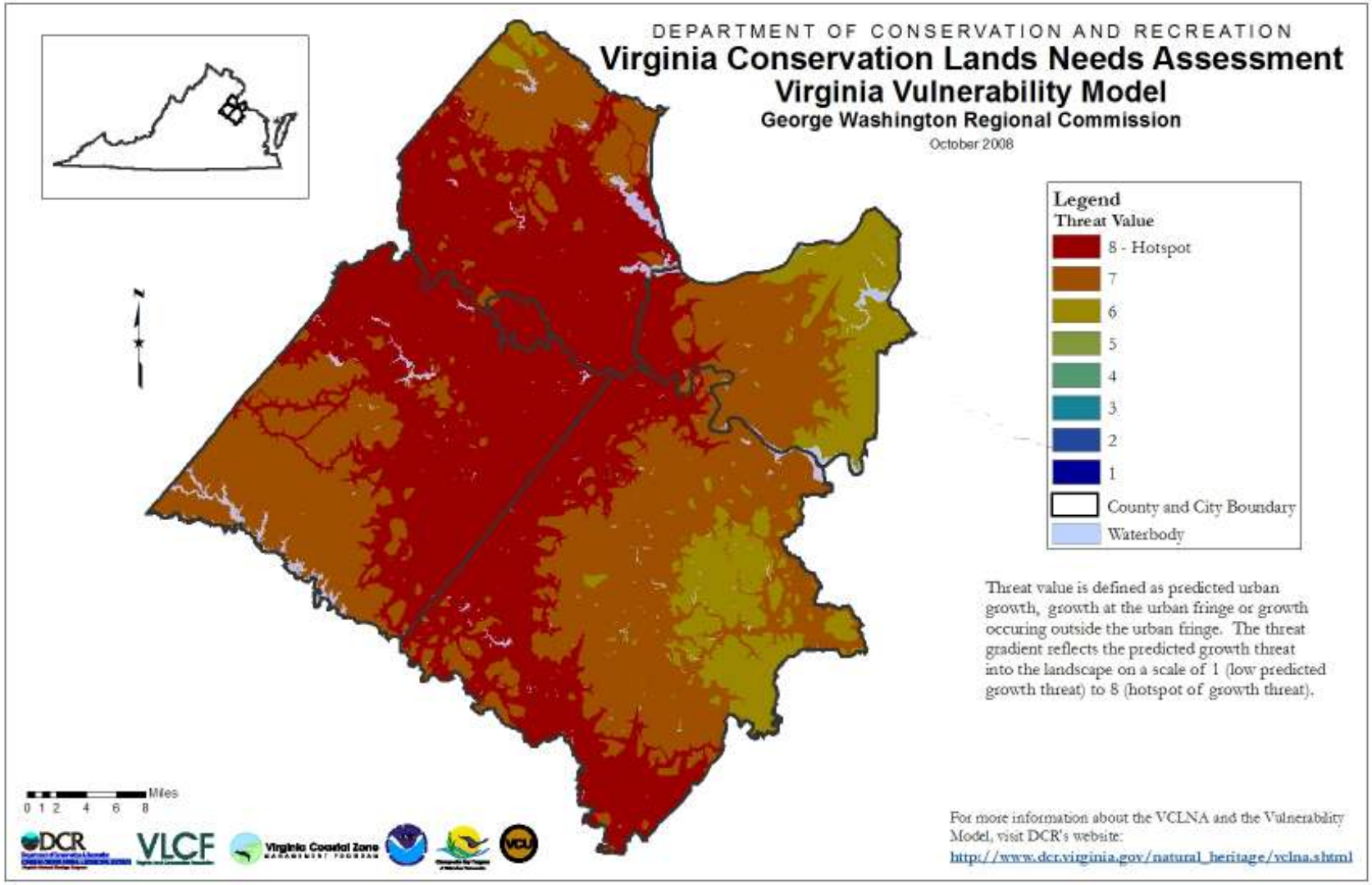


Figure 62. PDC 16 George Washington Regional Commission Urban Vulnerability Model.

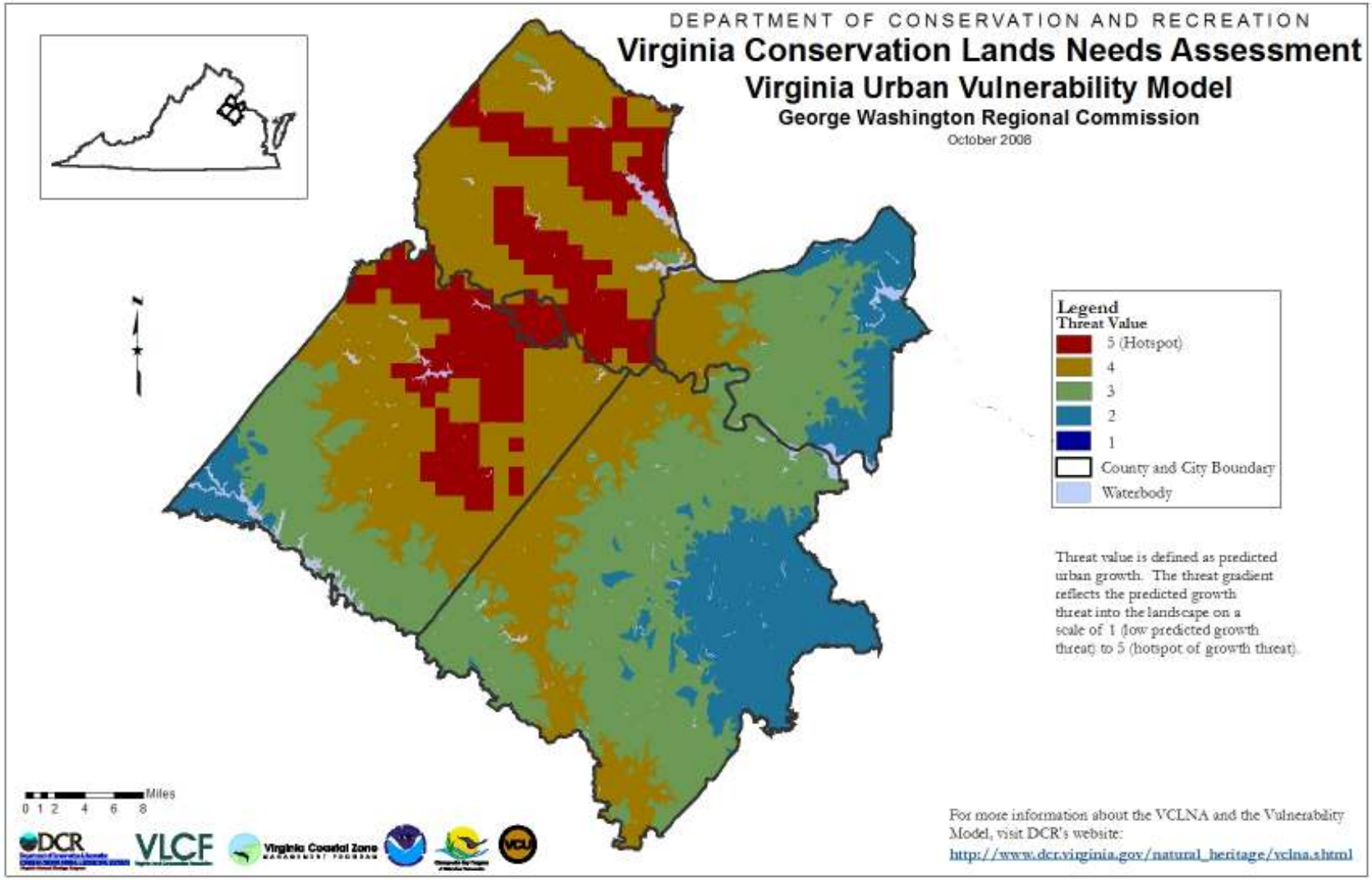


Figure 63. PDC 16 George Washington Regional Commission Urban Fringe Vulnerability Model.

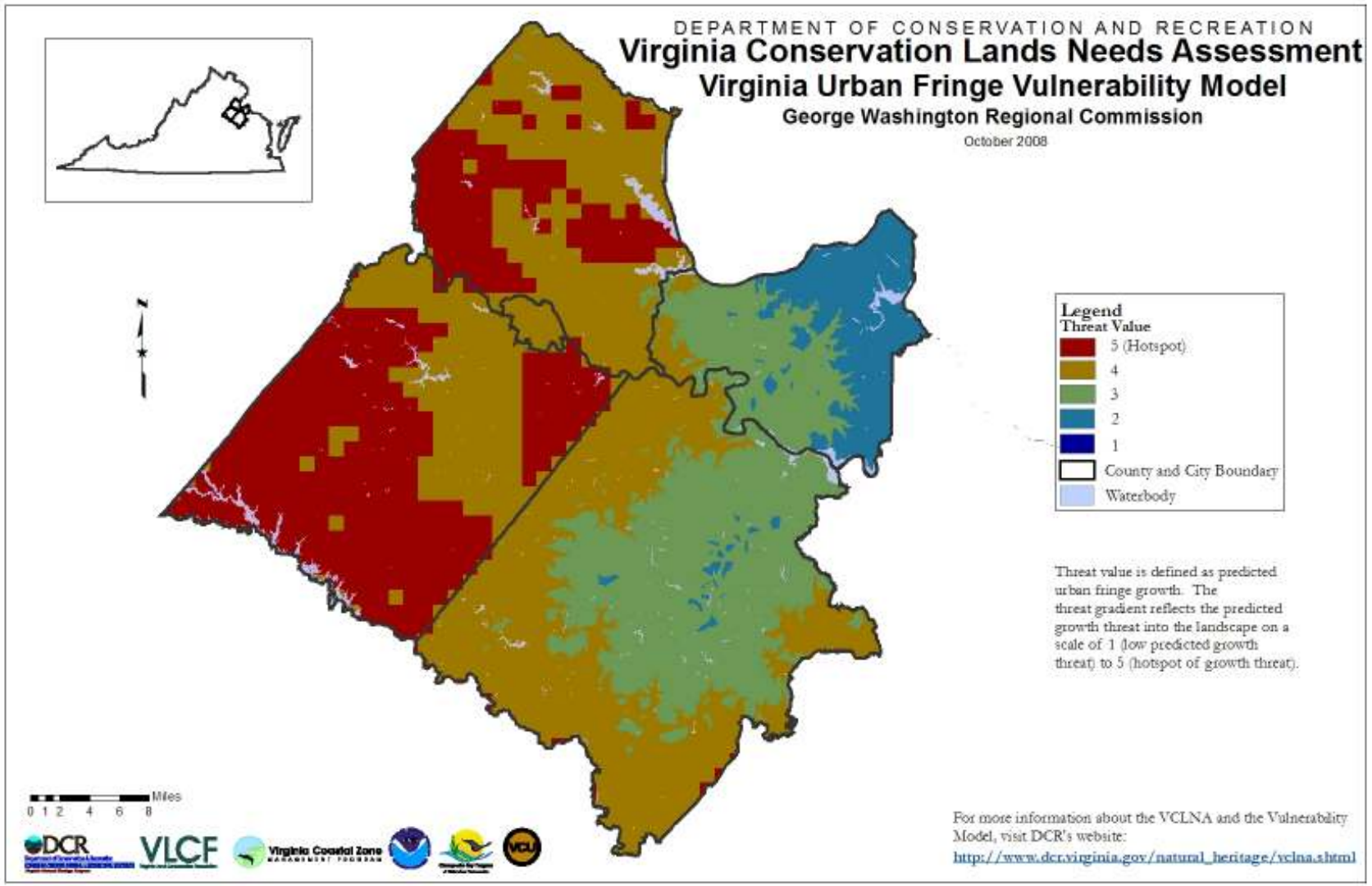


Figure 64. PDC 16 George Washington Regional Commission Outside the Urban Fringe Vulnerability Model.

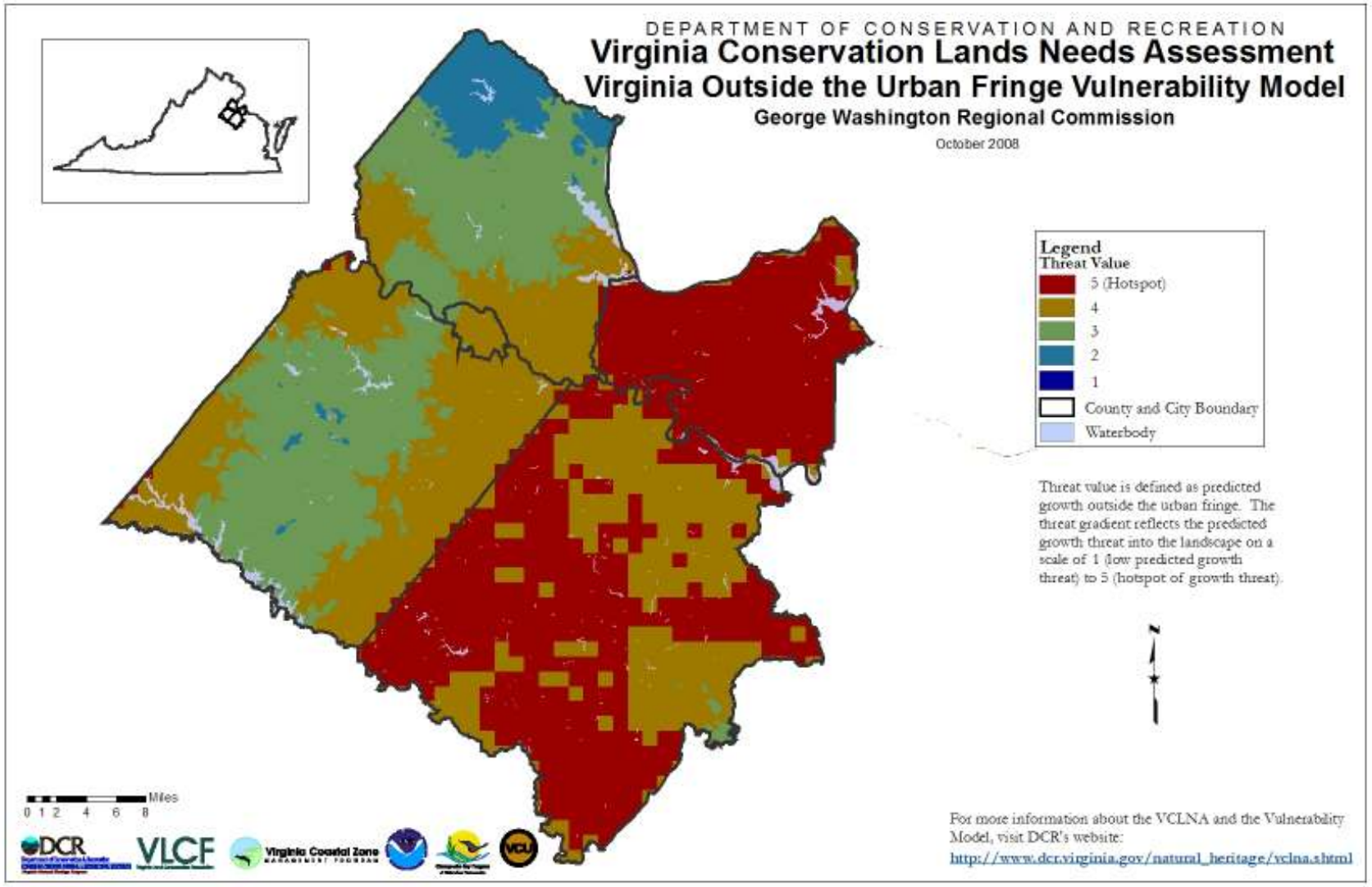


Figure 65. PDC 17 Northern Neck Vulnerability Model.

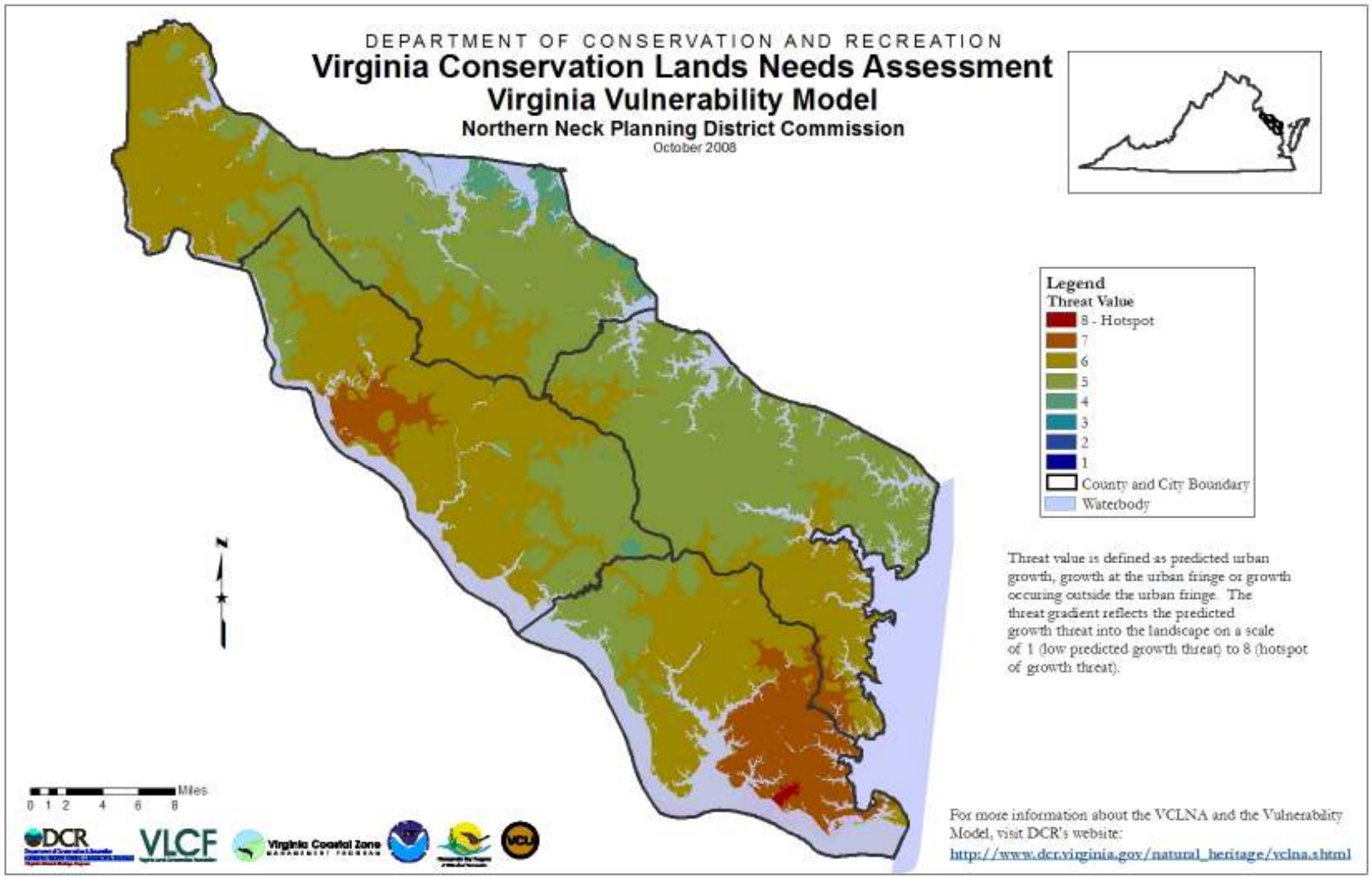


Figure 66. PDC 17 Northern Neck Urban Vulnerability Model.

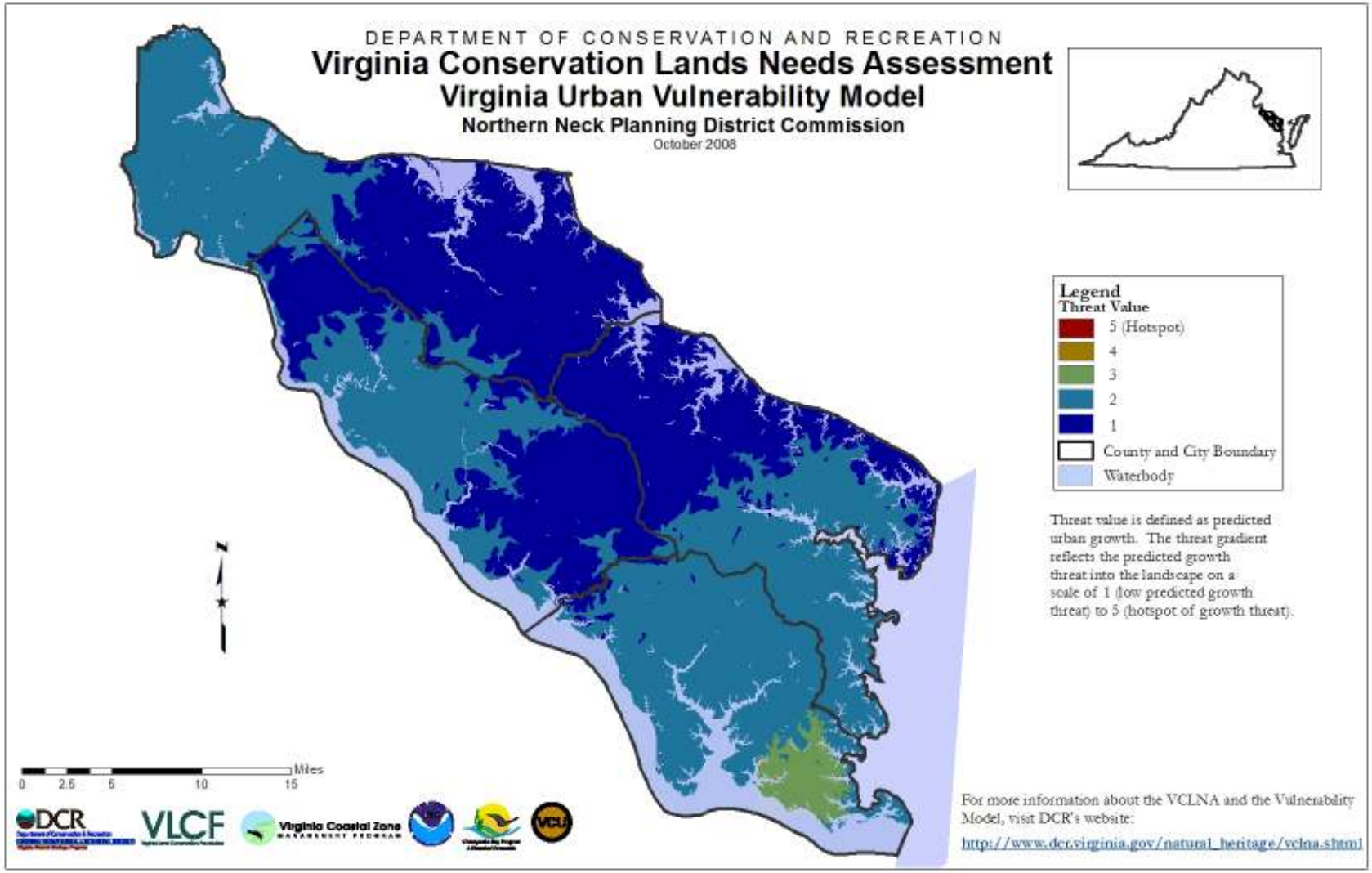


Figure 67. PDC 17 Northern Neck Urban Fringe Vulnerability Model.

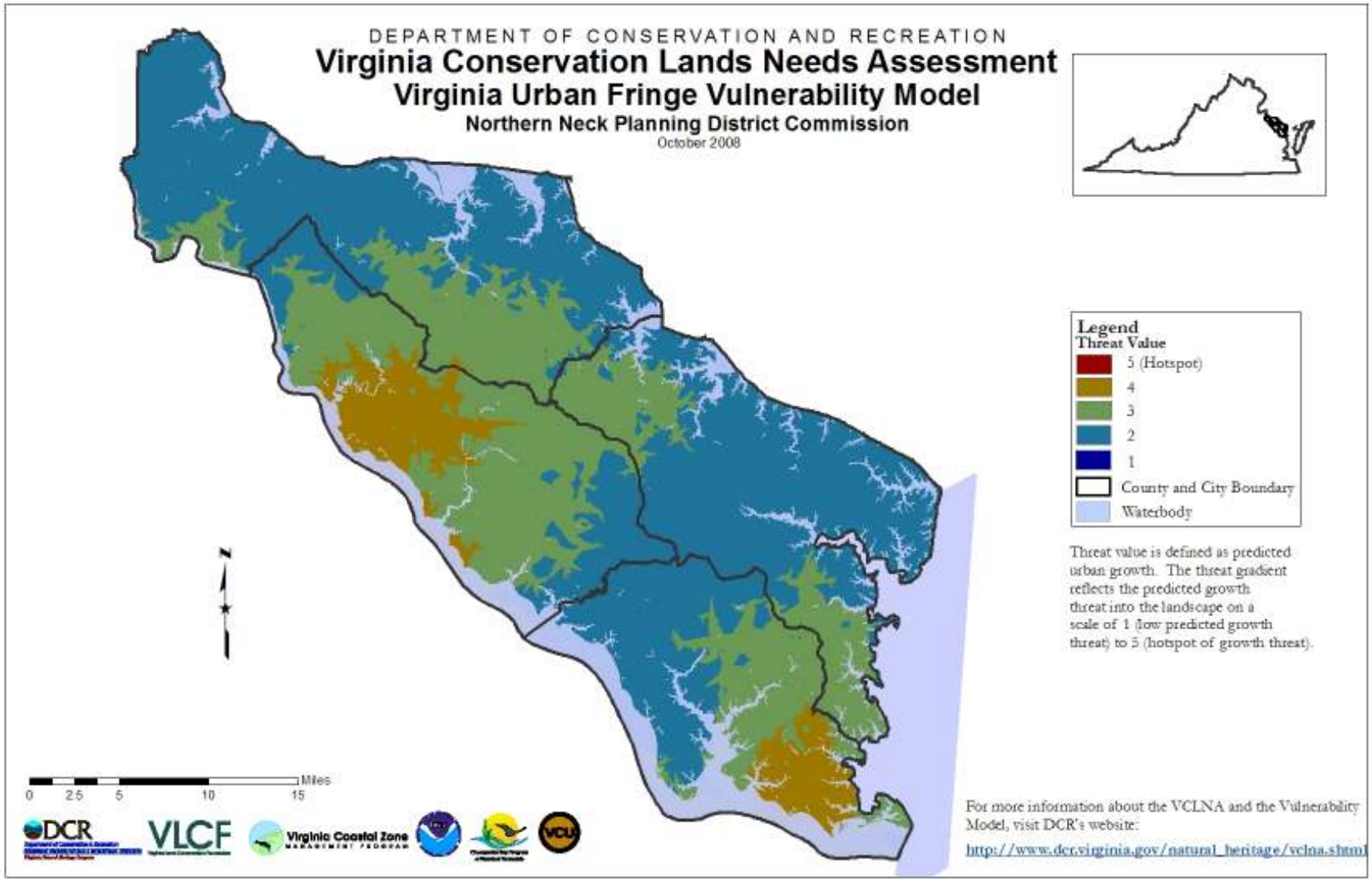


Figure 68. PDC 17 Northern Neck Outside the Urban Fringe Vulnerability Model.

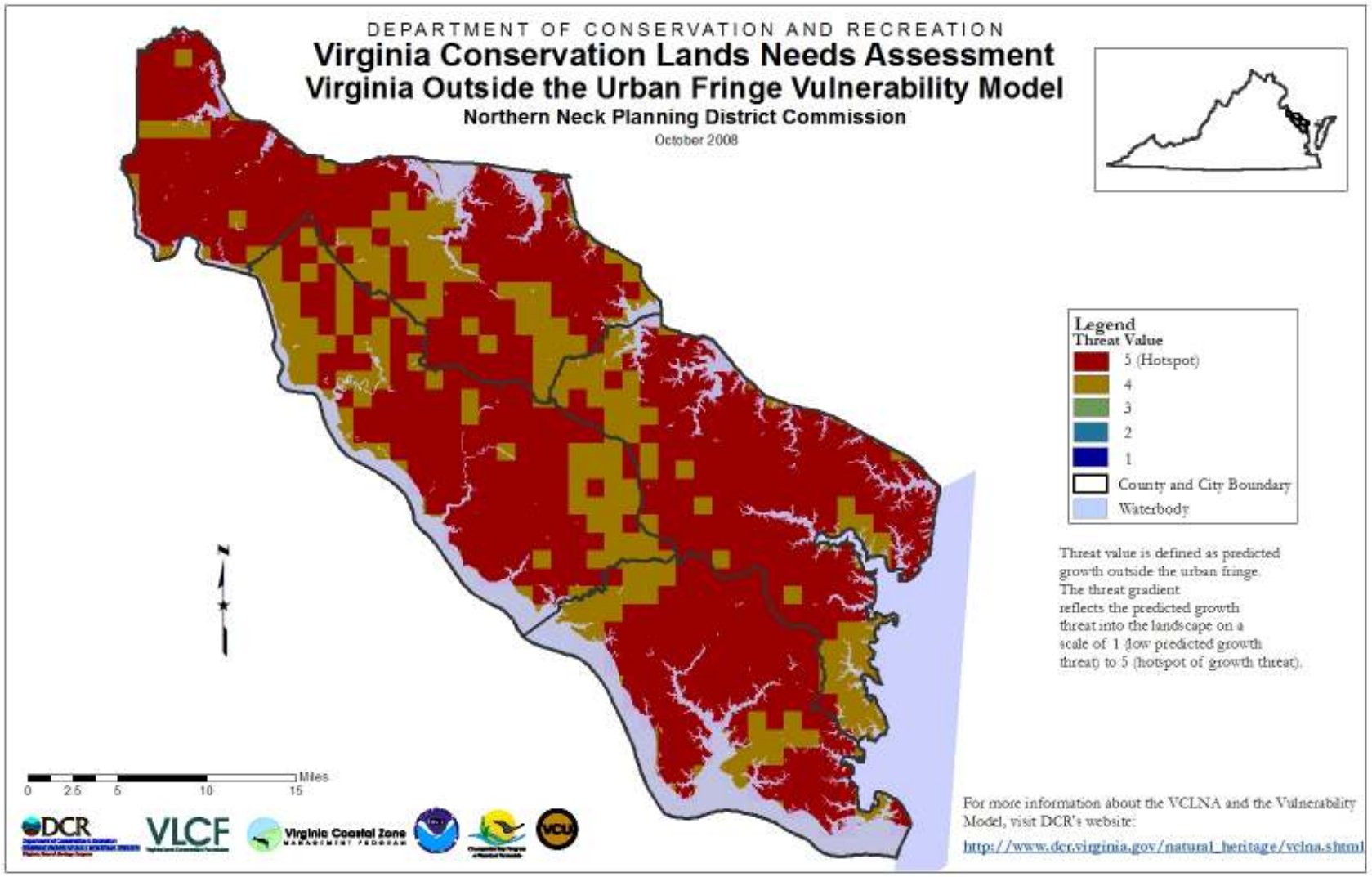


Figure 69. PDC 18 Middle Peninsula Vulnerability Model.

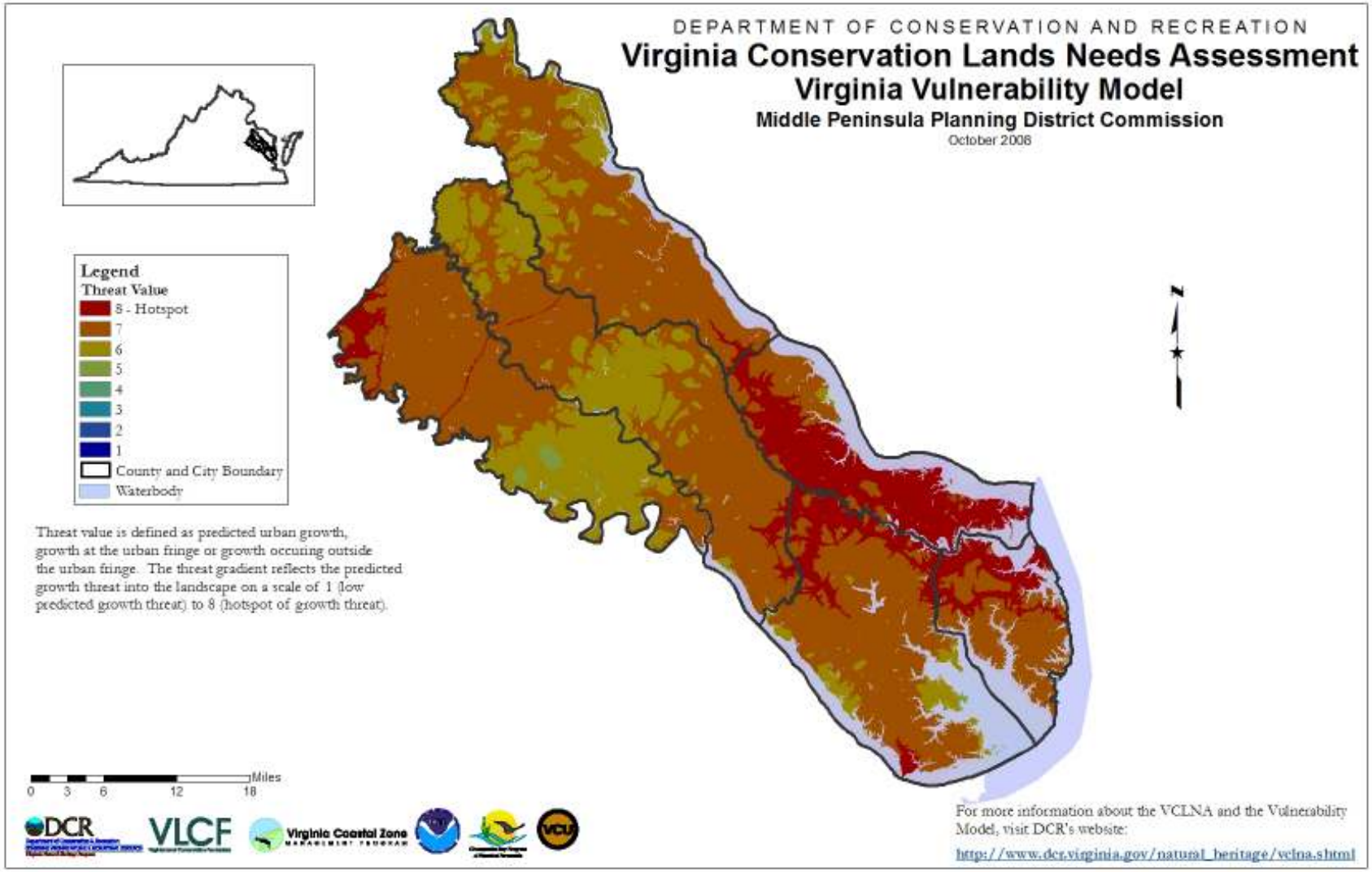


Figure 70. PDC 18 Middle Peninsula Urban Vulnerability Model.

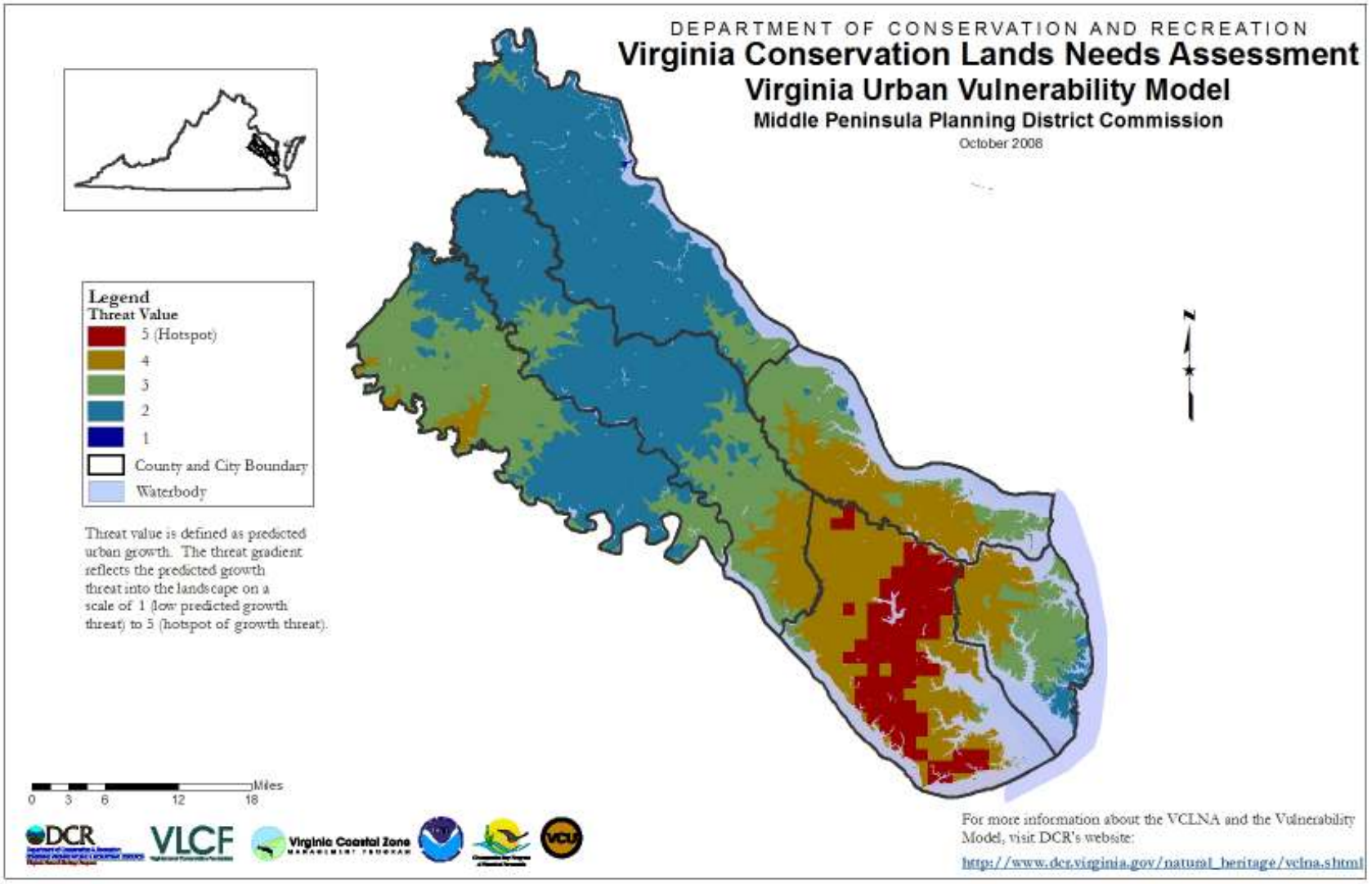


Figure 71. PDC 18 Middle Peninsula Urban Fringe Vulnerability Model.

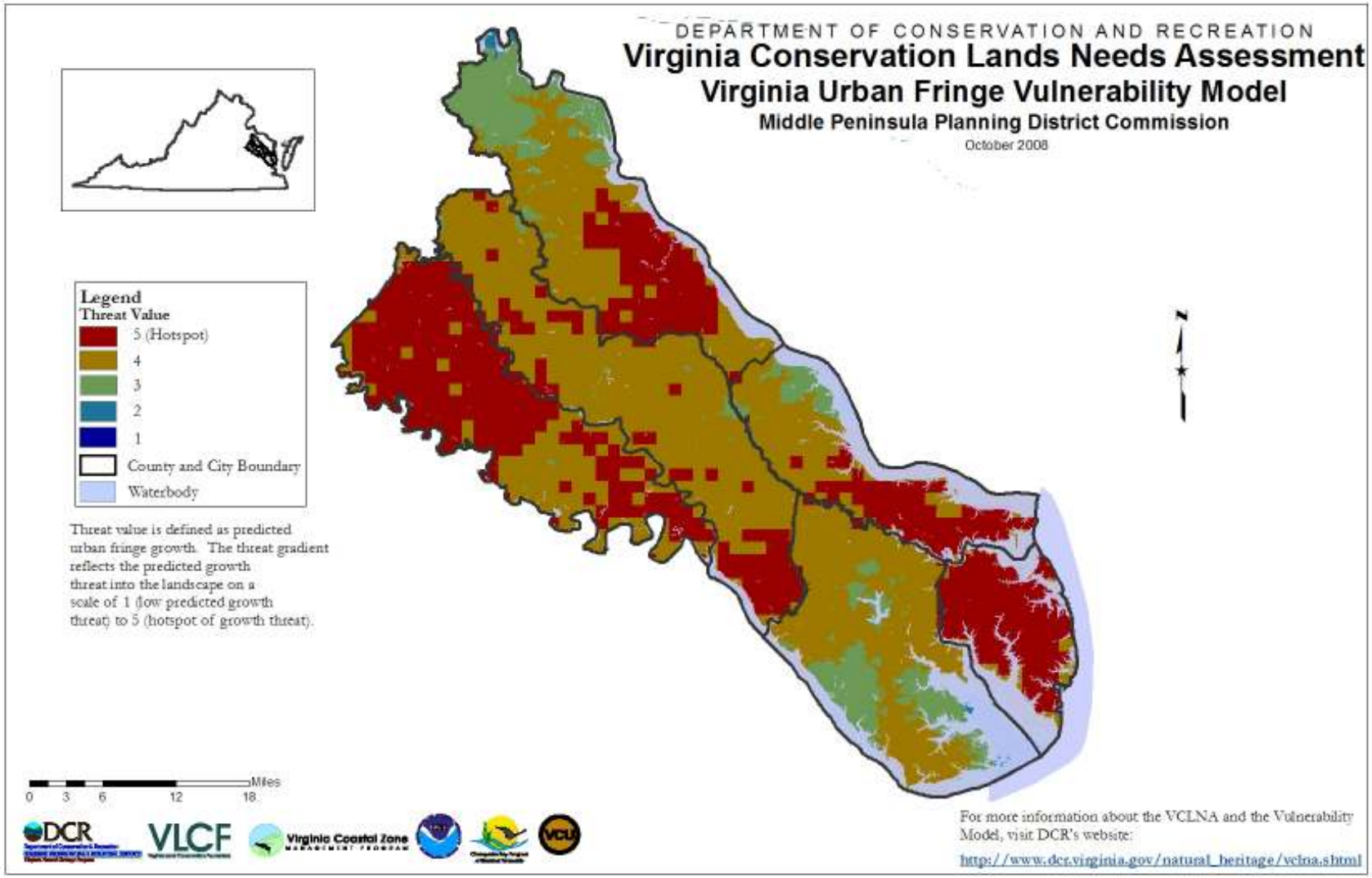


Figure 72. PDC 18 Middle Peninsula Outside the Urban Fringe Vulnerability Model.

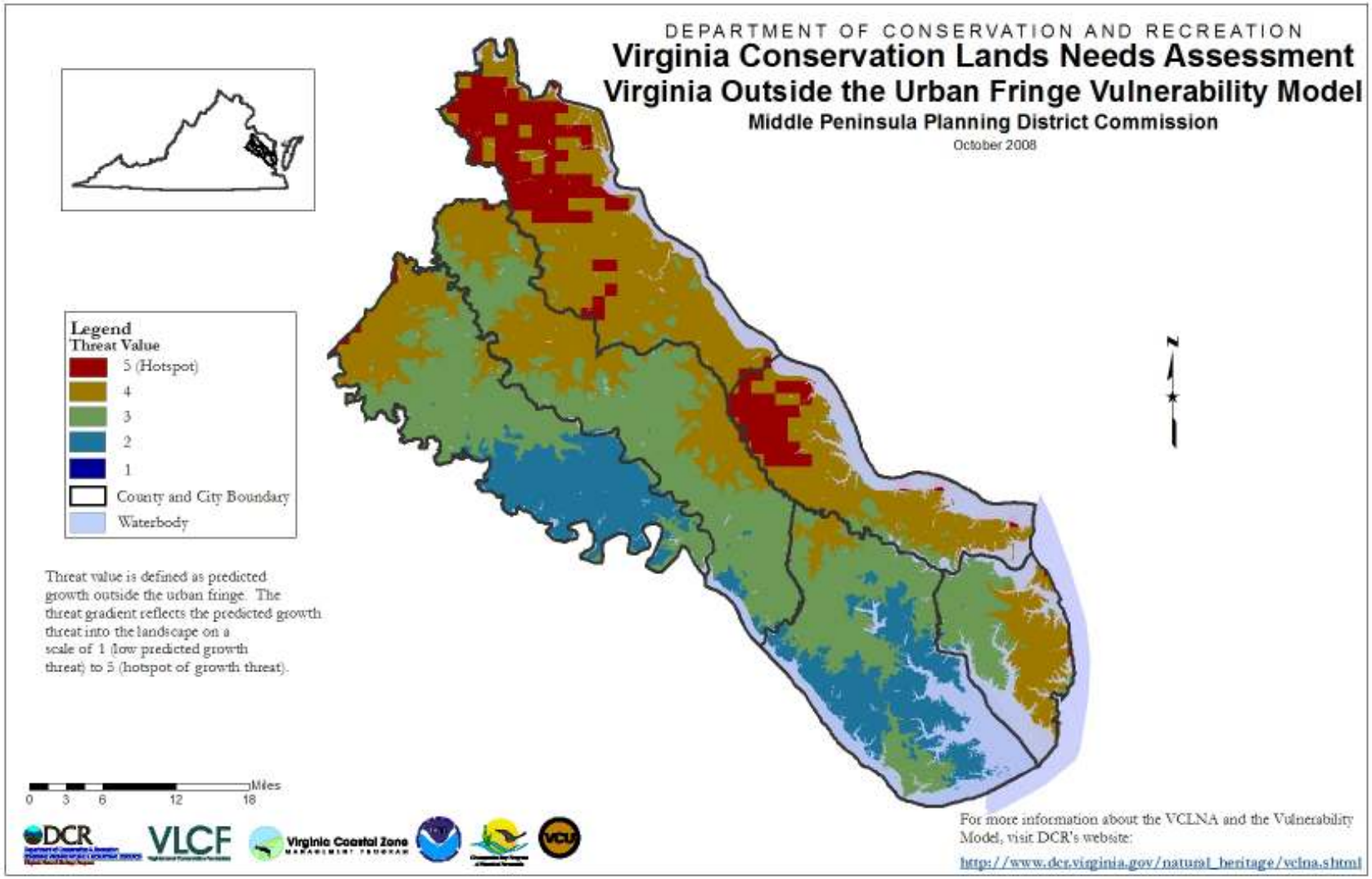


Figure 73. PDC 19 Crater Vulnerability Model.

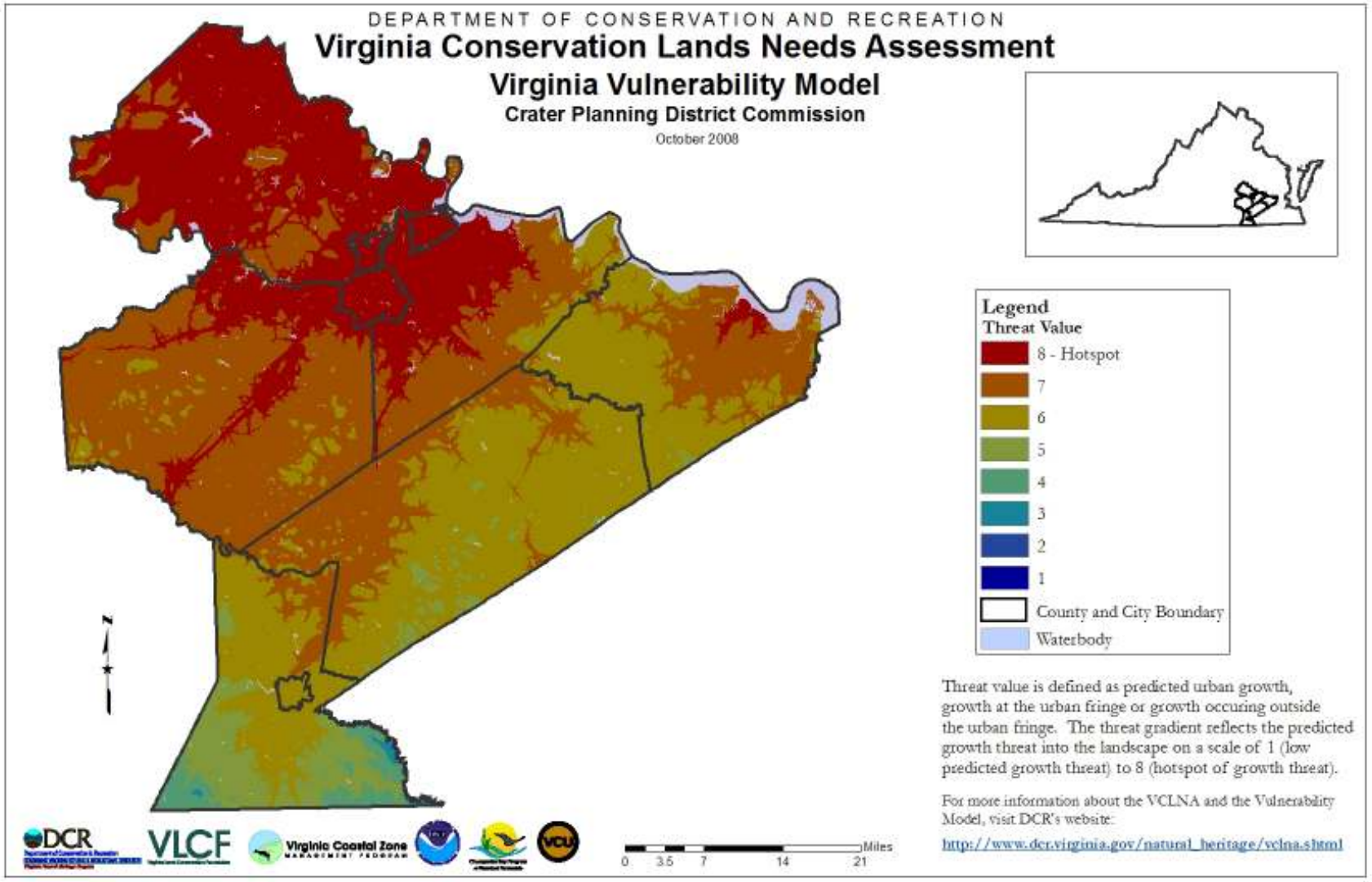


Figure 74. PDC 19 Crater Urban Vulnerability Model.

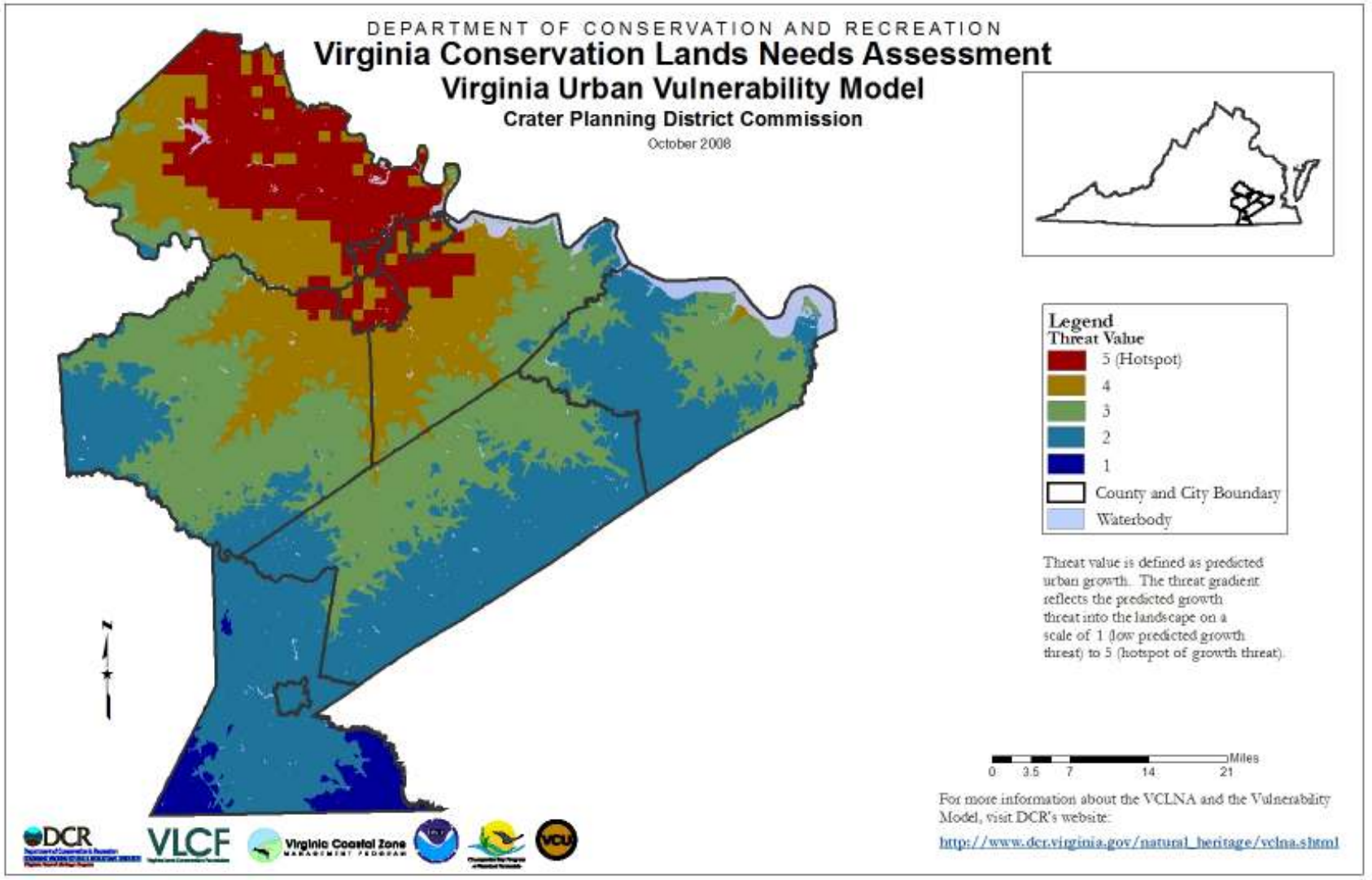


Figure 75. PDC 19 Crater Urban Fringe Vulnerability Model.

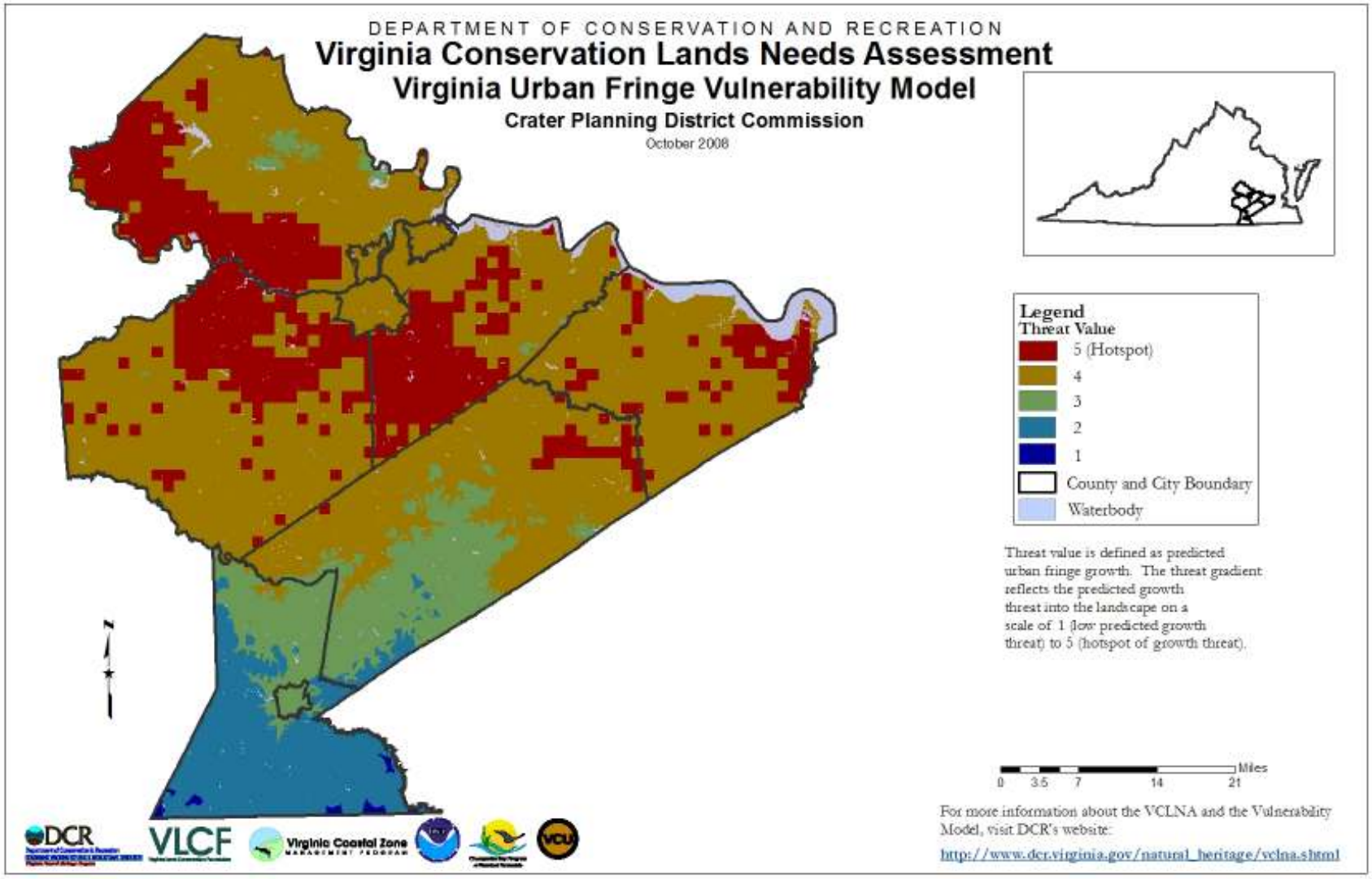


Figure 76. PDC 19 Crater Outside the Urban Fringe Vulnerability Model.

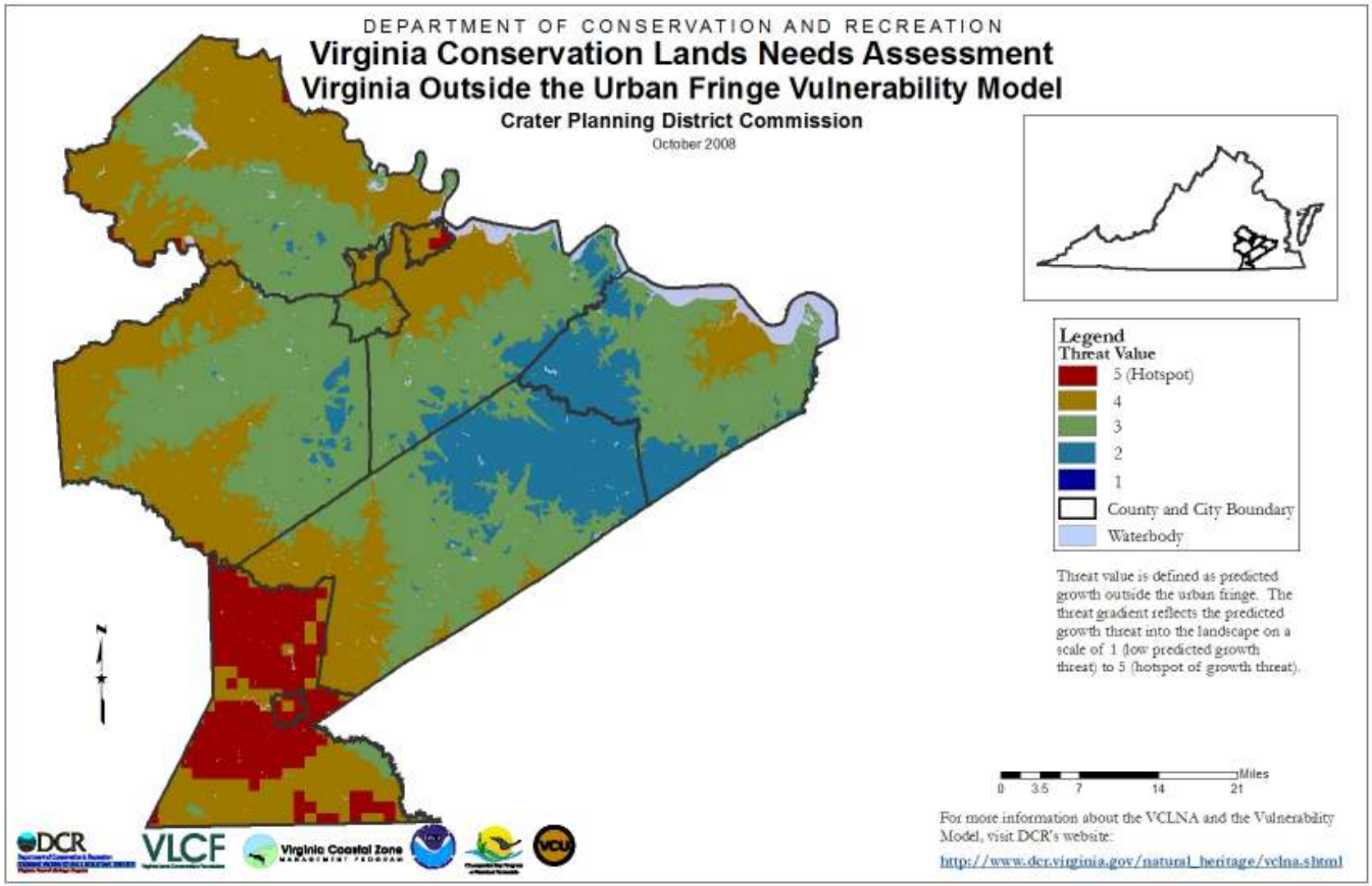


Figure 77. PDC 22 Accomack-Northampton Planning District Commission Vulnerability Model.

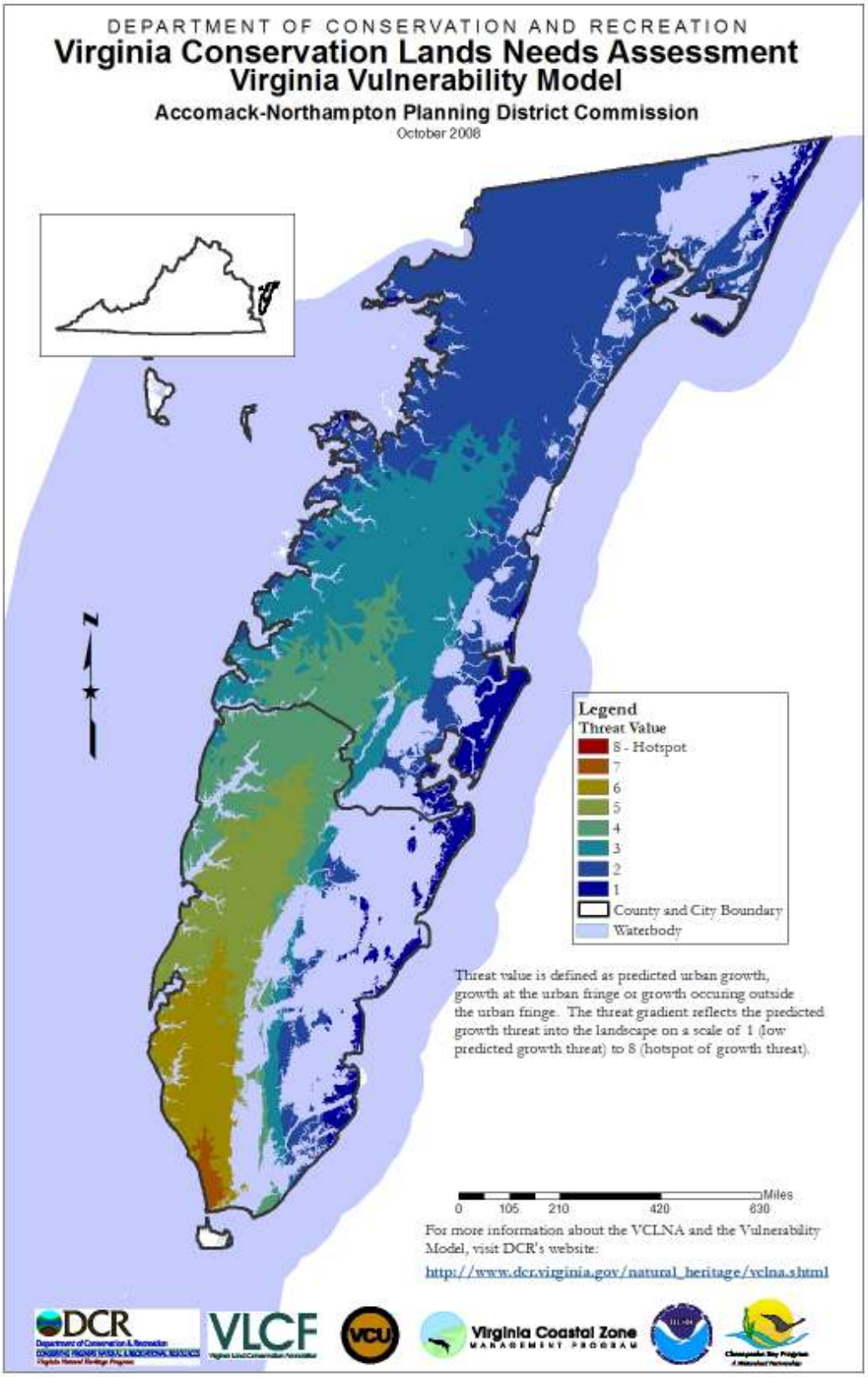


Figure 78. PDC 22 Accomack-Northampton Planning District Commission Urban Vulnerability Model.

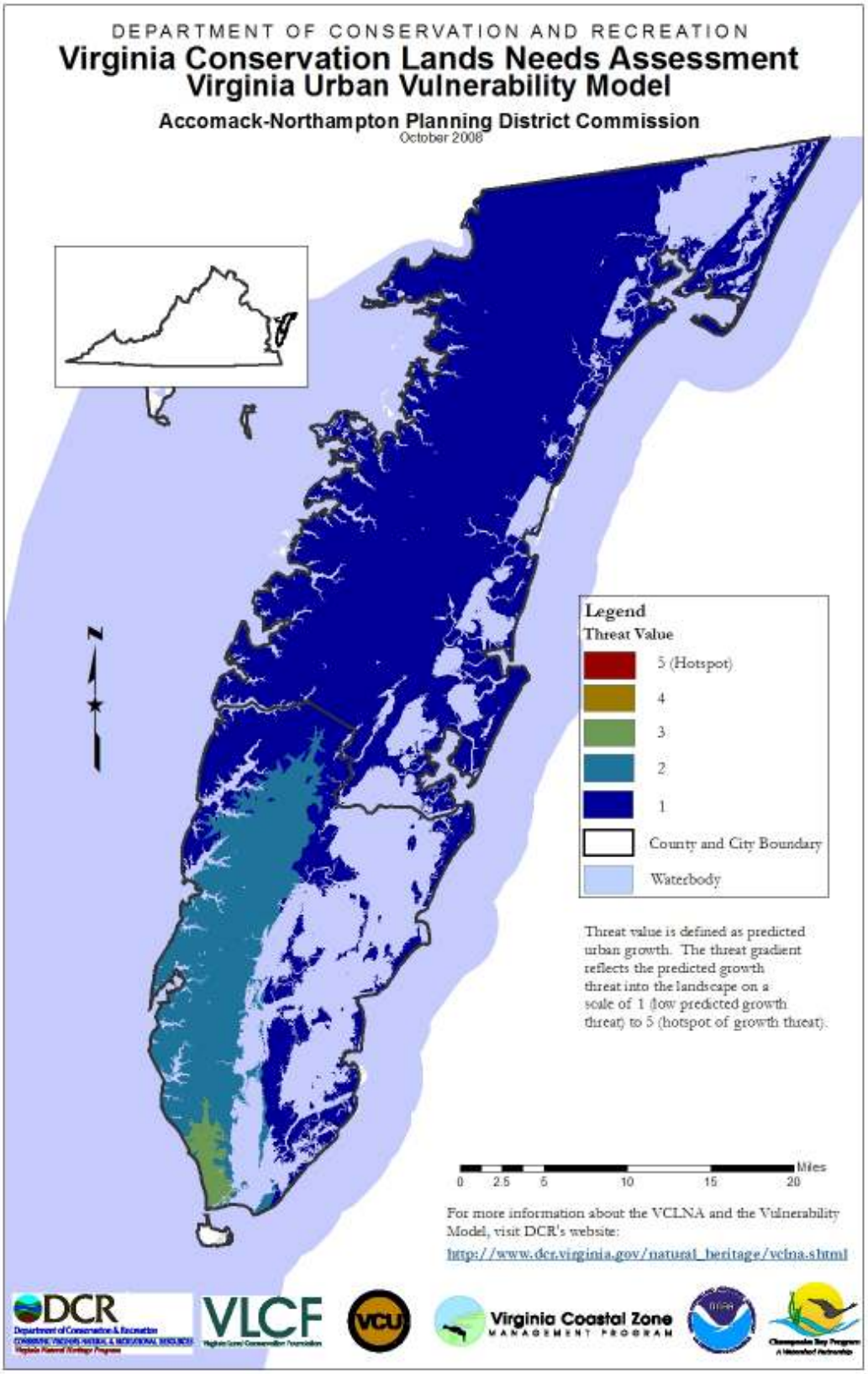


Figure 79. PDC 22 Accomack-Northampton Planning District Commission Urban Fringe Vulnerability Model.

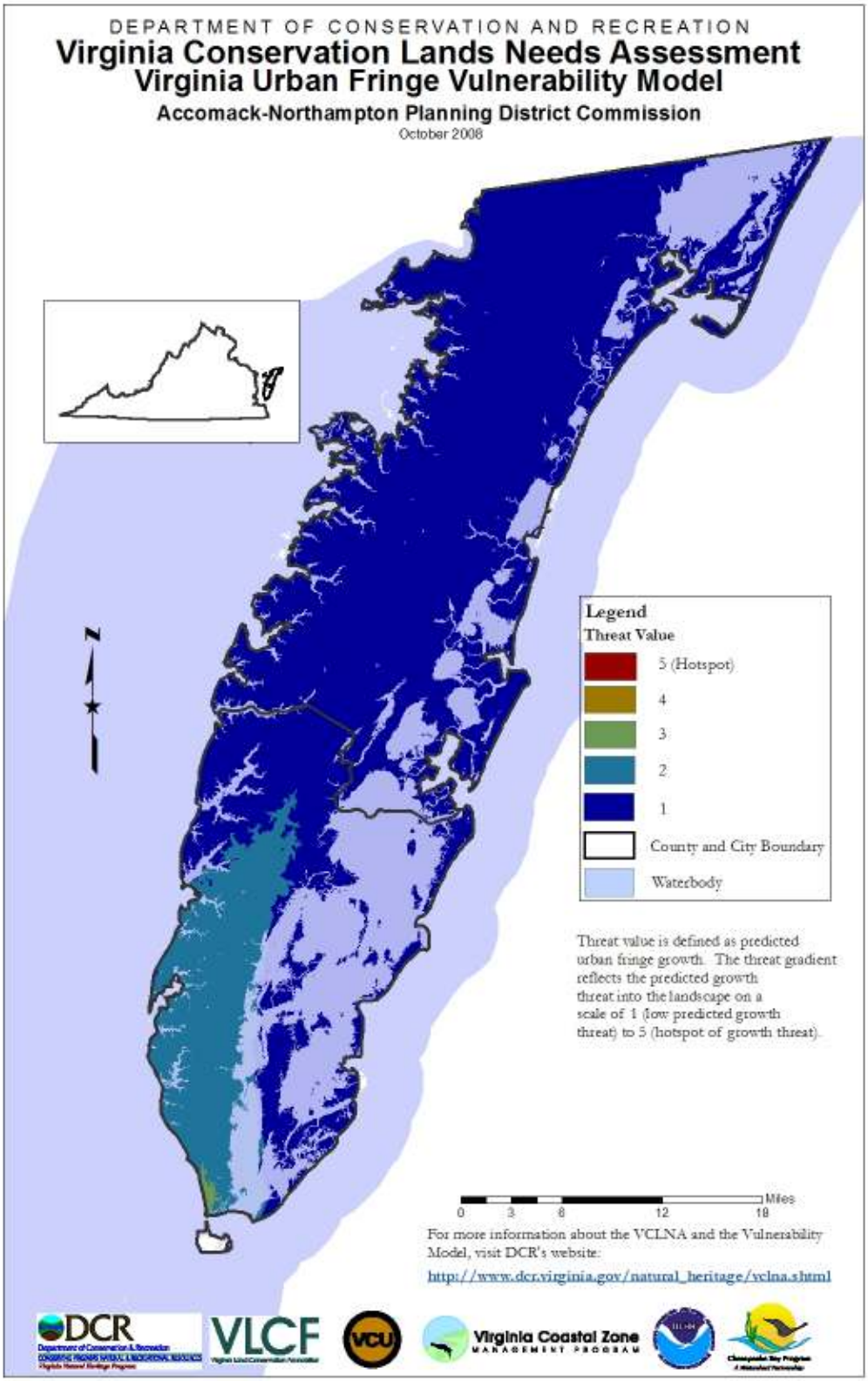


Figure 80. PDC 22 Accomack-Northampton Planning District Commission Outside the Urban Fringe Vulnerability Model

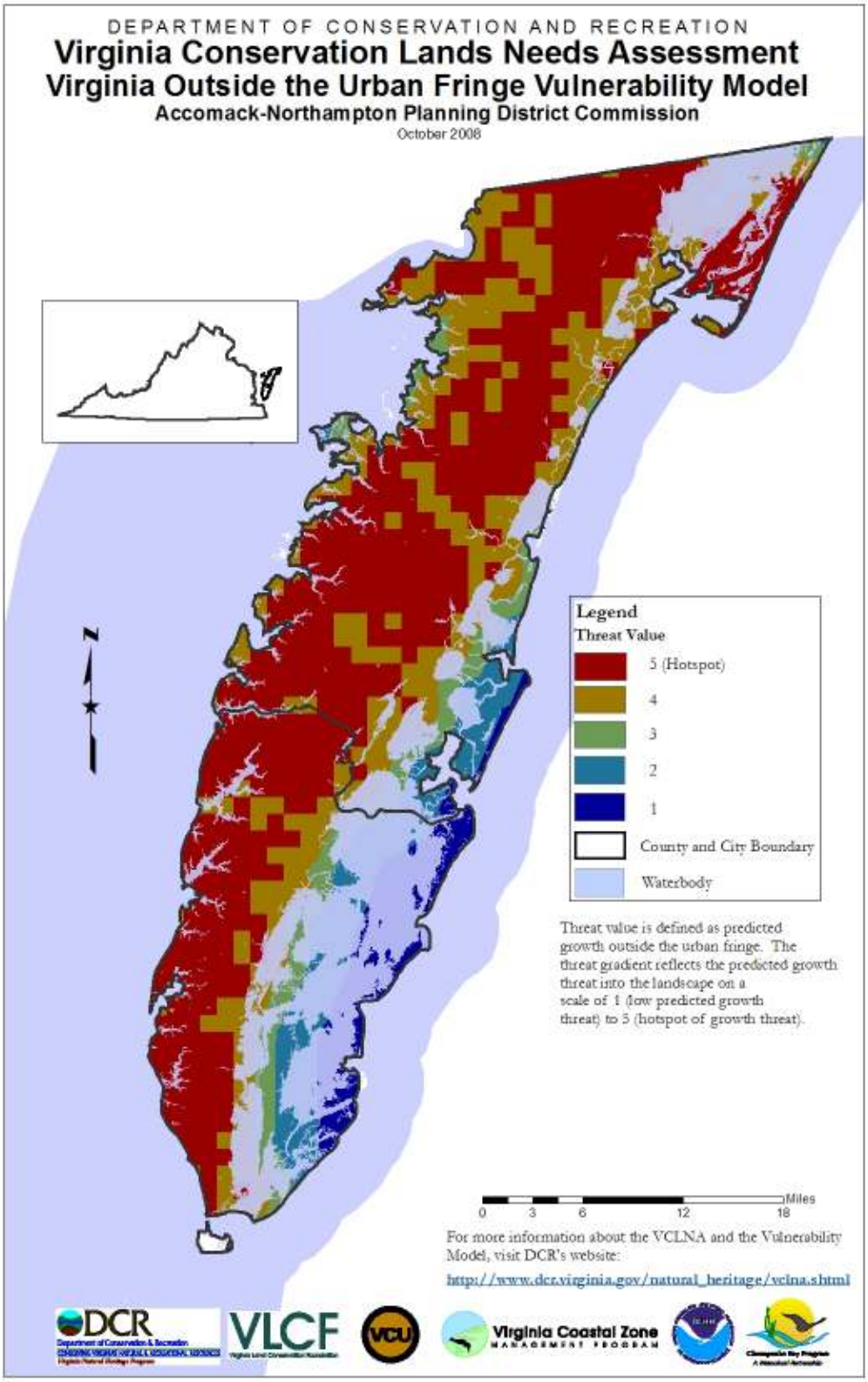


Figure 81. PDC 23 Hampton Roads Planning District Commission Vulnerability Model

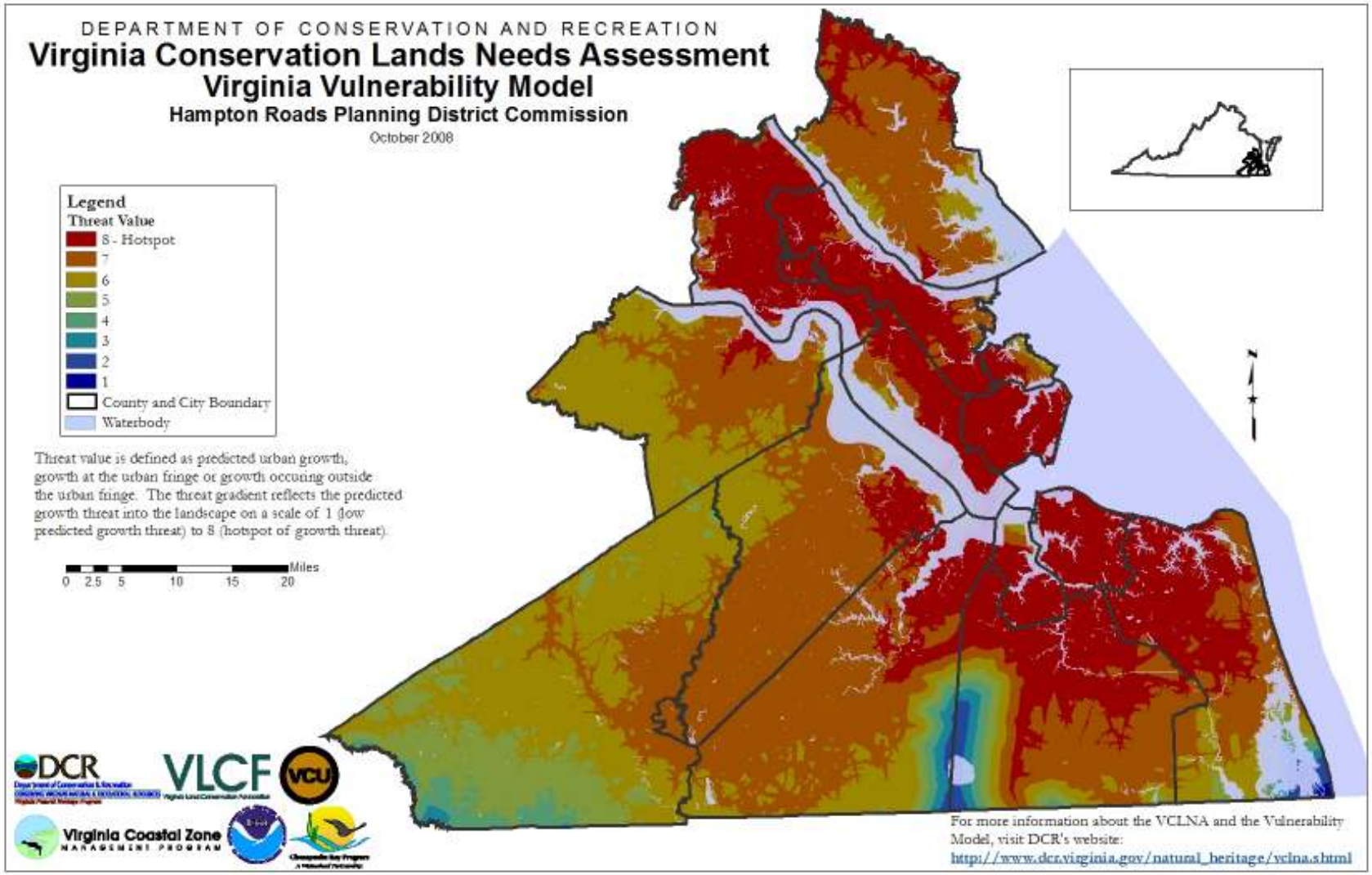


Figure 82. PDC 23 Hampton Roads Planning District Commission Urban Vulnerability Model

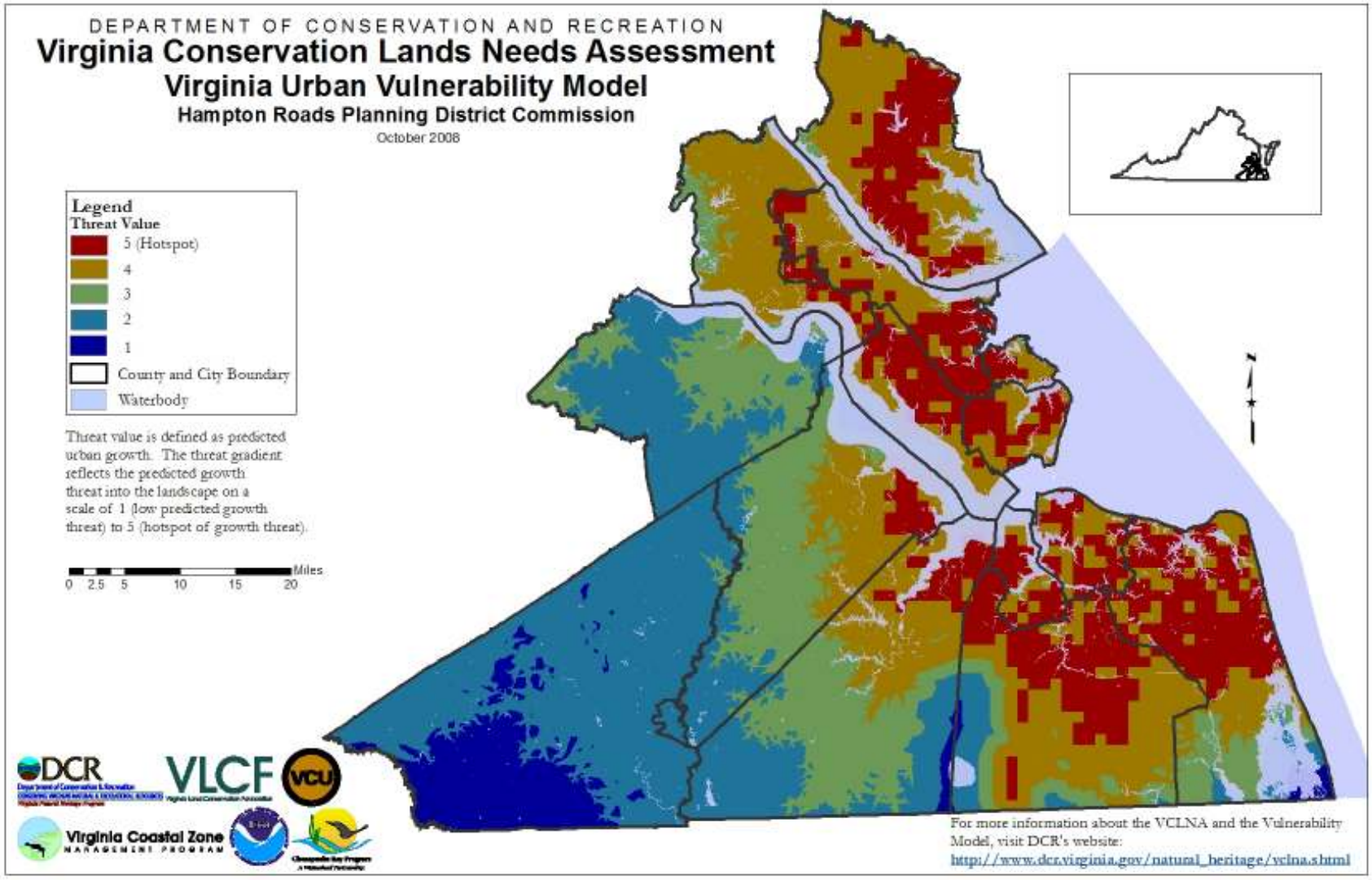


Figure 83. PDC 23 Hampton Roads Planning District Commission Urban Fringe Vulnerability Model

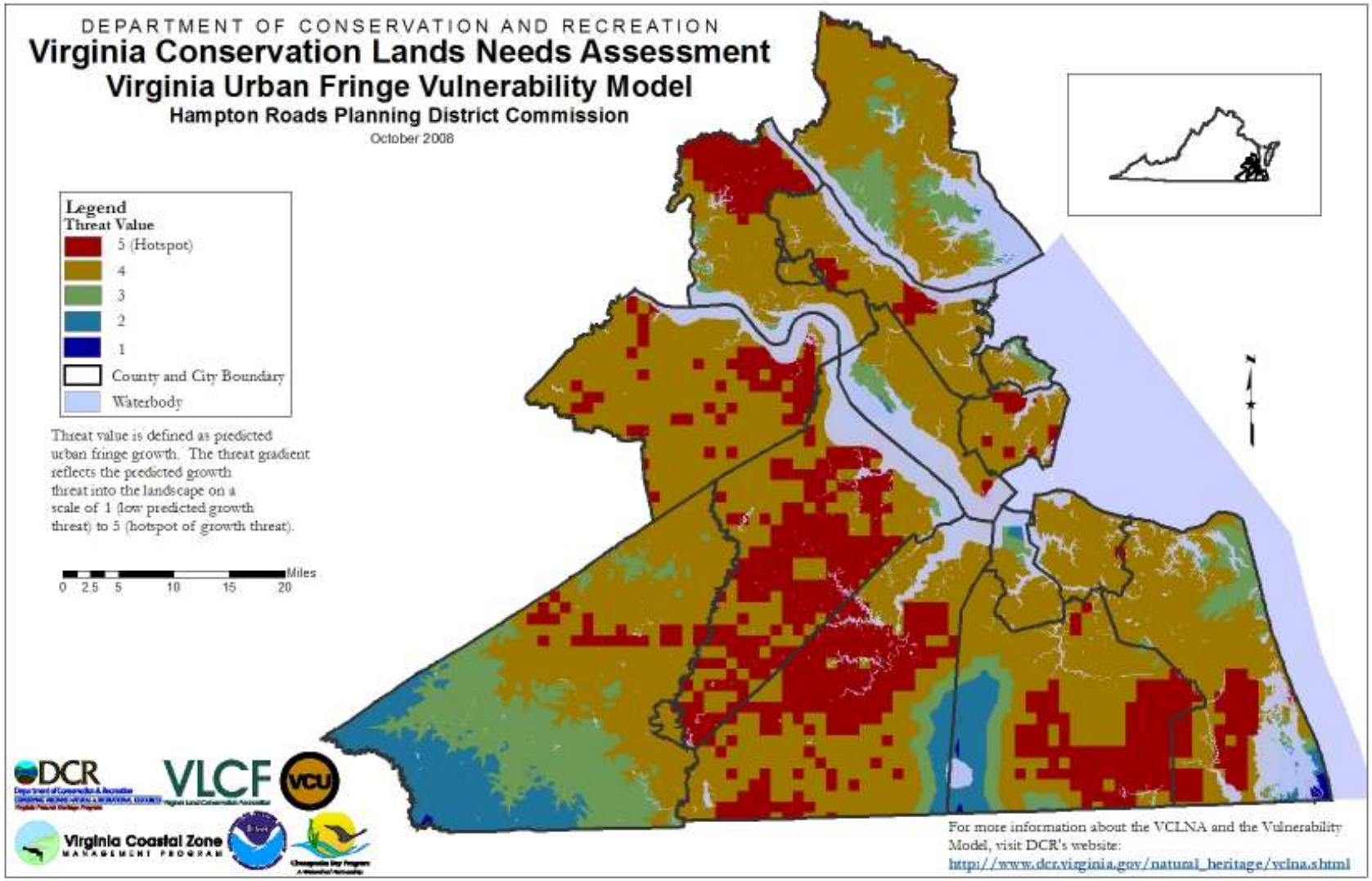


Figure 84. PDC 23 Hampton Roads Planning District Commission Outside the Urban Fringe Vulnerability Model

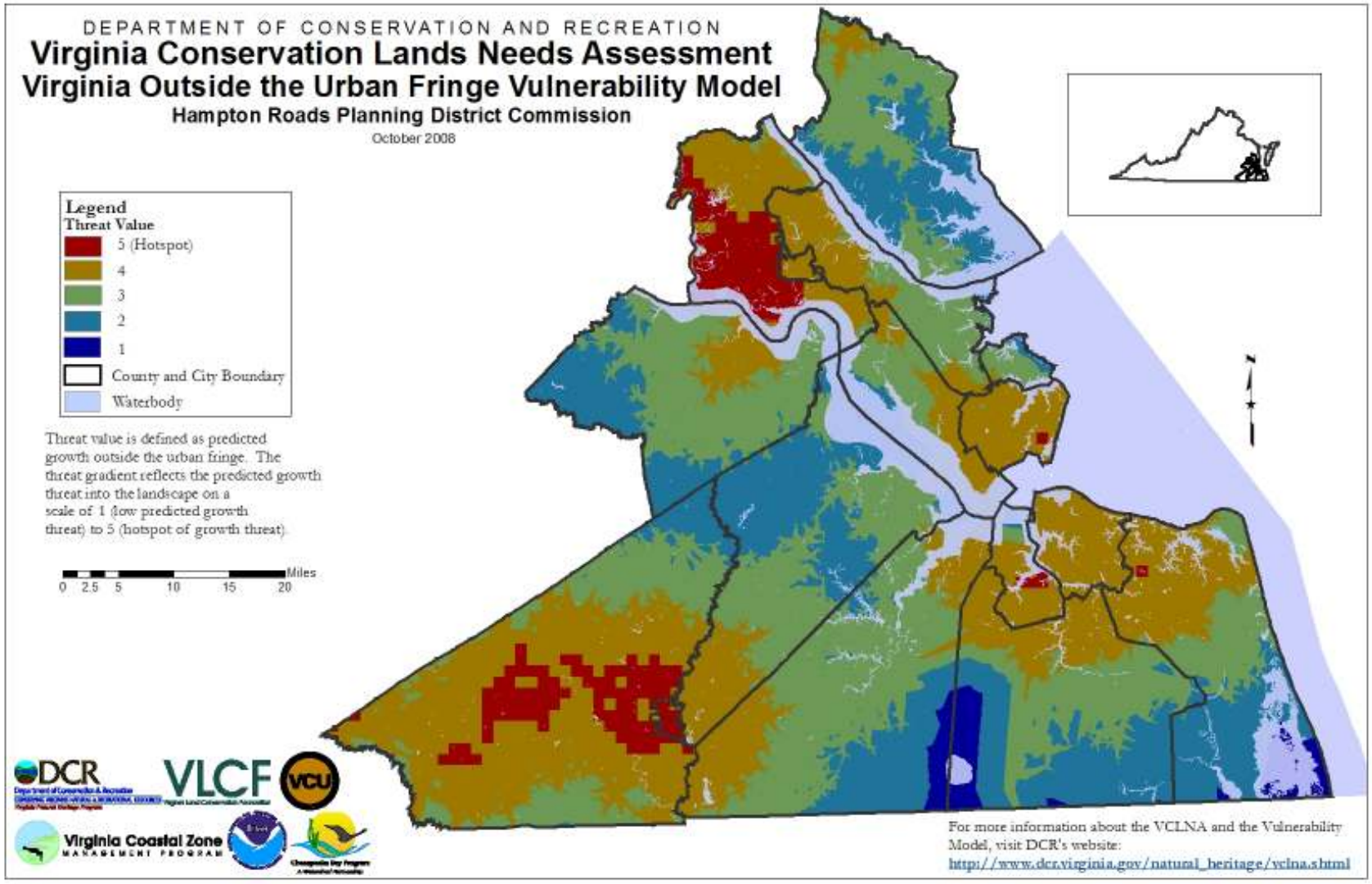


Figure 85. Coastal Zone Vulnerability Model.

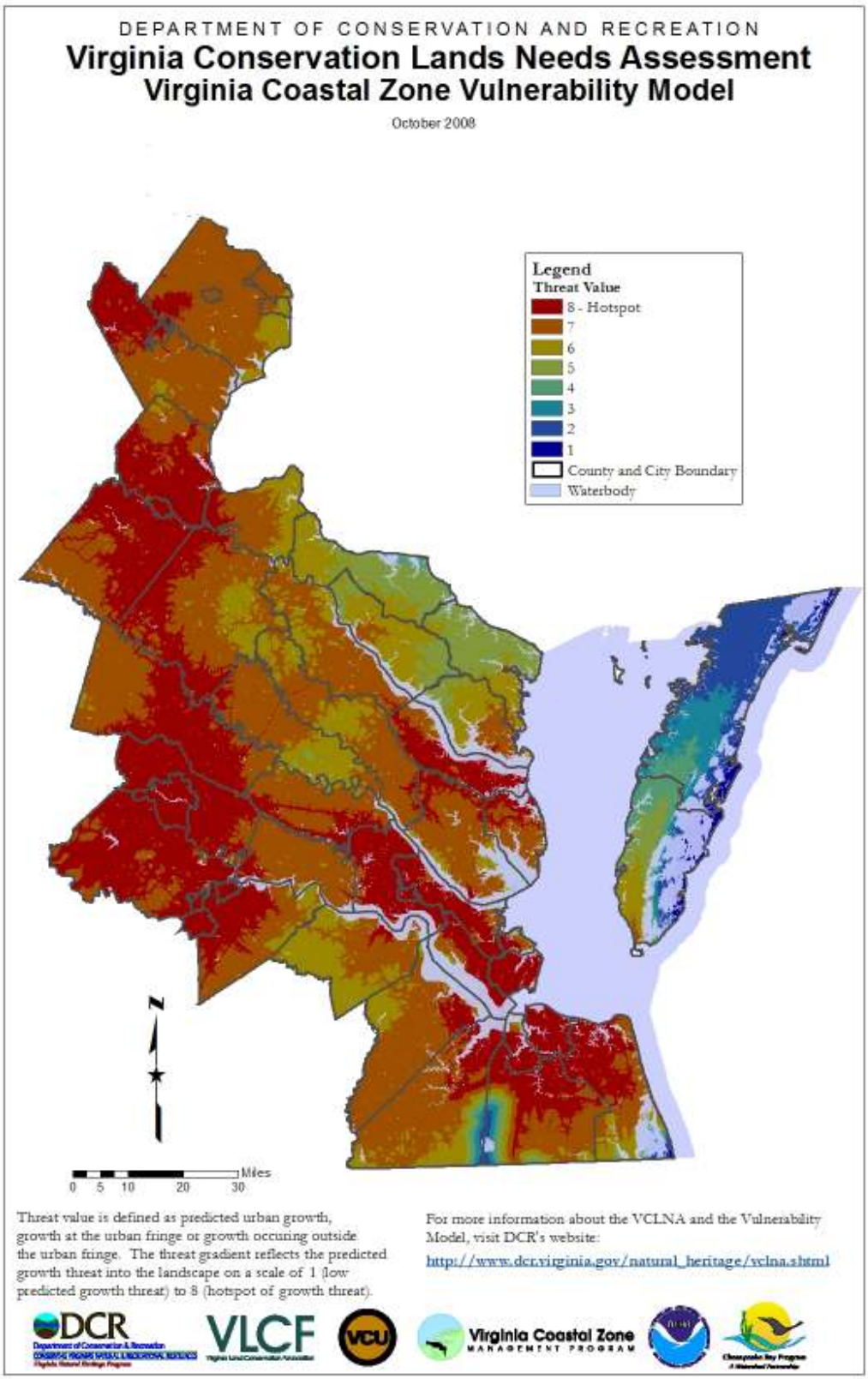


Figure 86. Coastal Zone Urban Vulnerability Model.

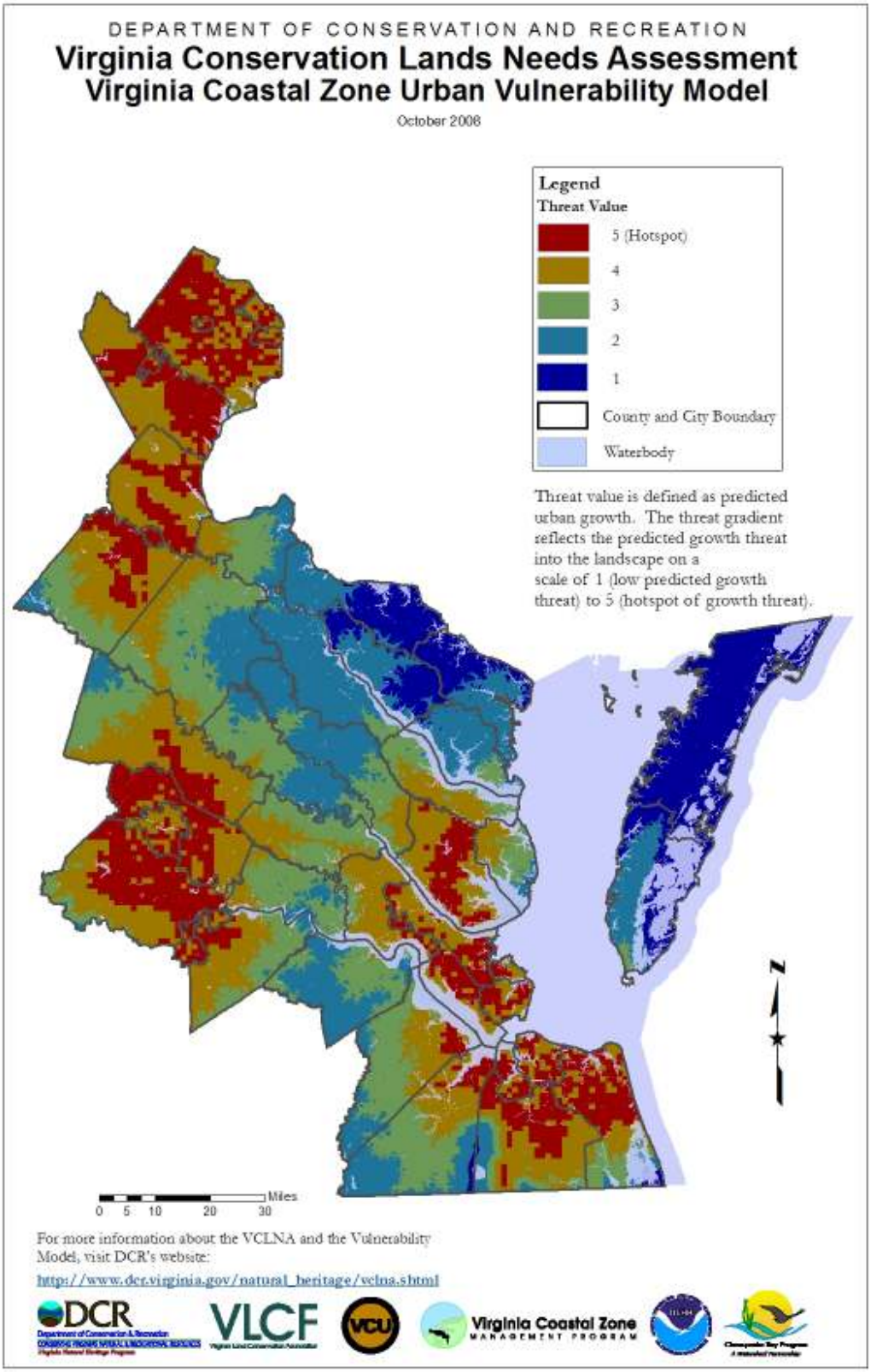


Figure 87. Coastal Zone Urban Fringe Vulnerability Model.

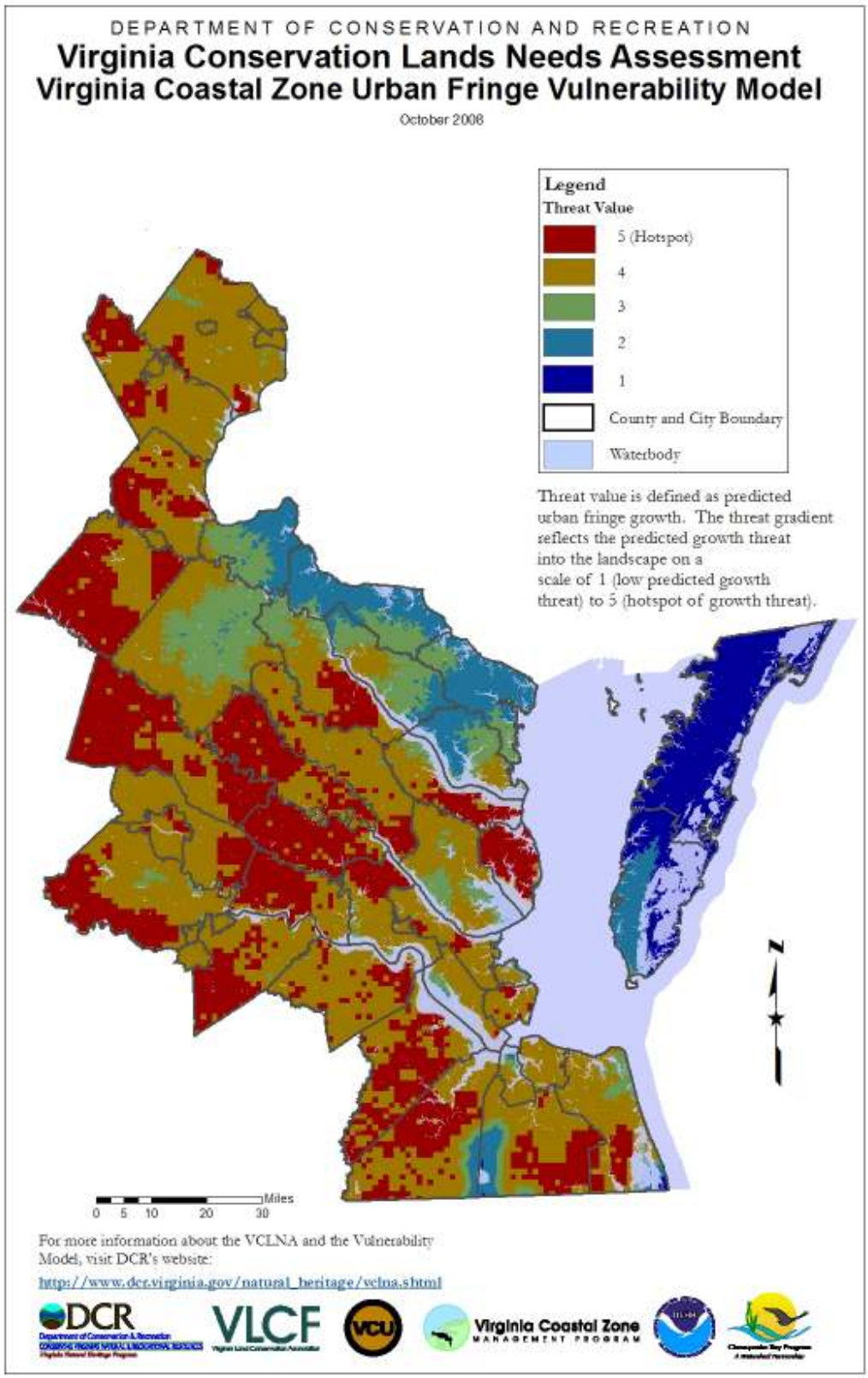


Figure 88. Coastal Zone Outside the Urban Fringe Vulnerability Model.

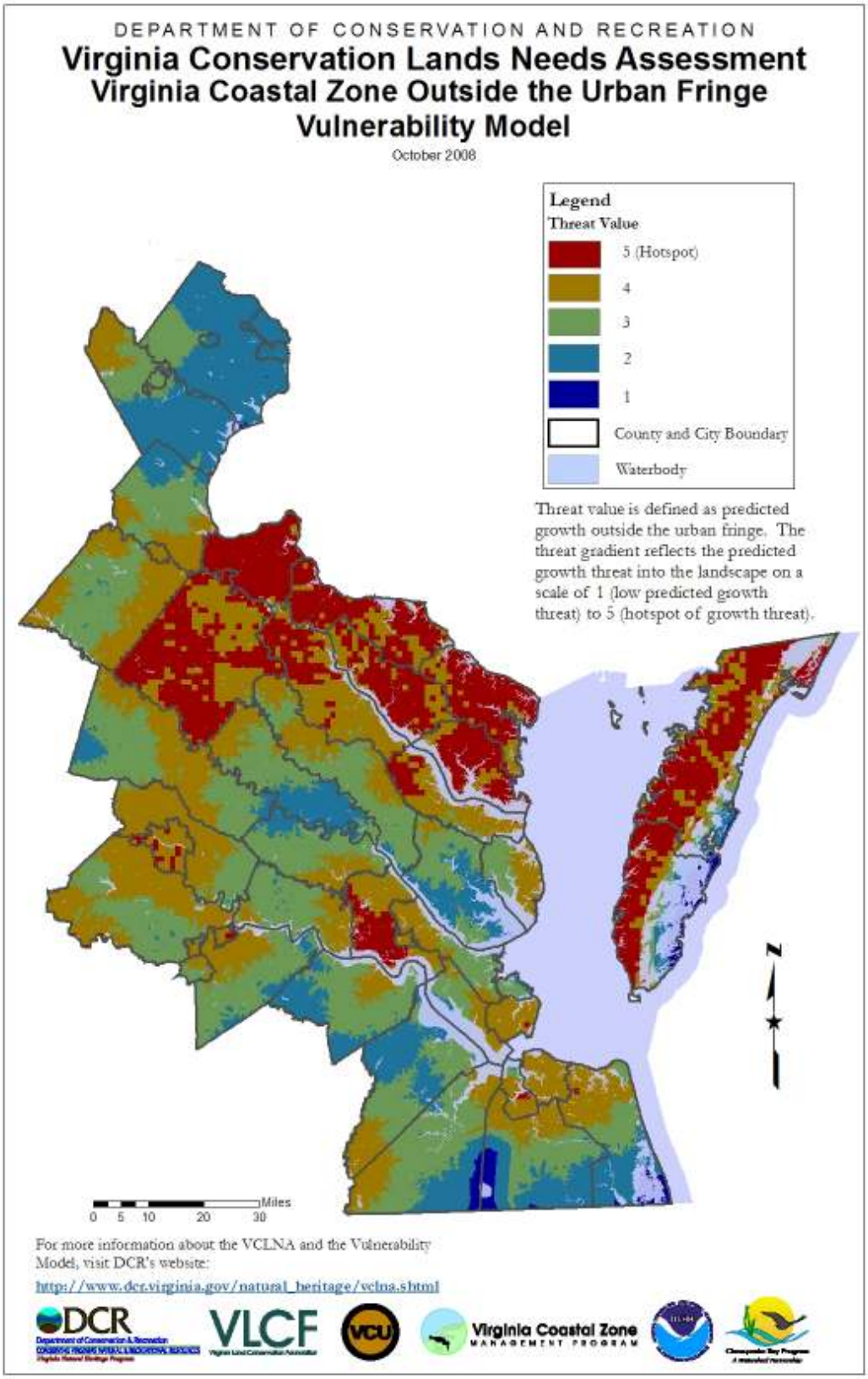


Figure 89. Virginia Vulnerability Model.

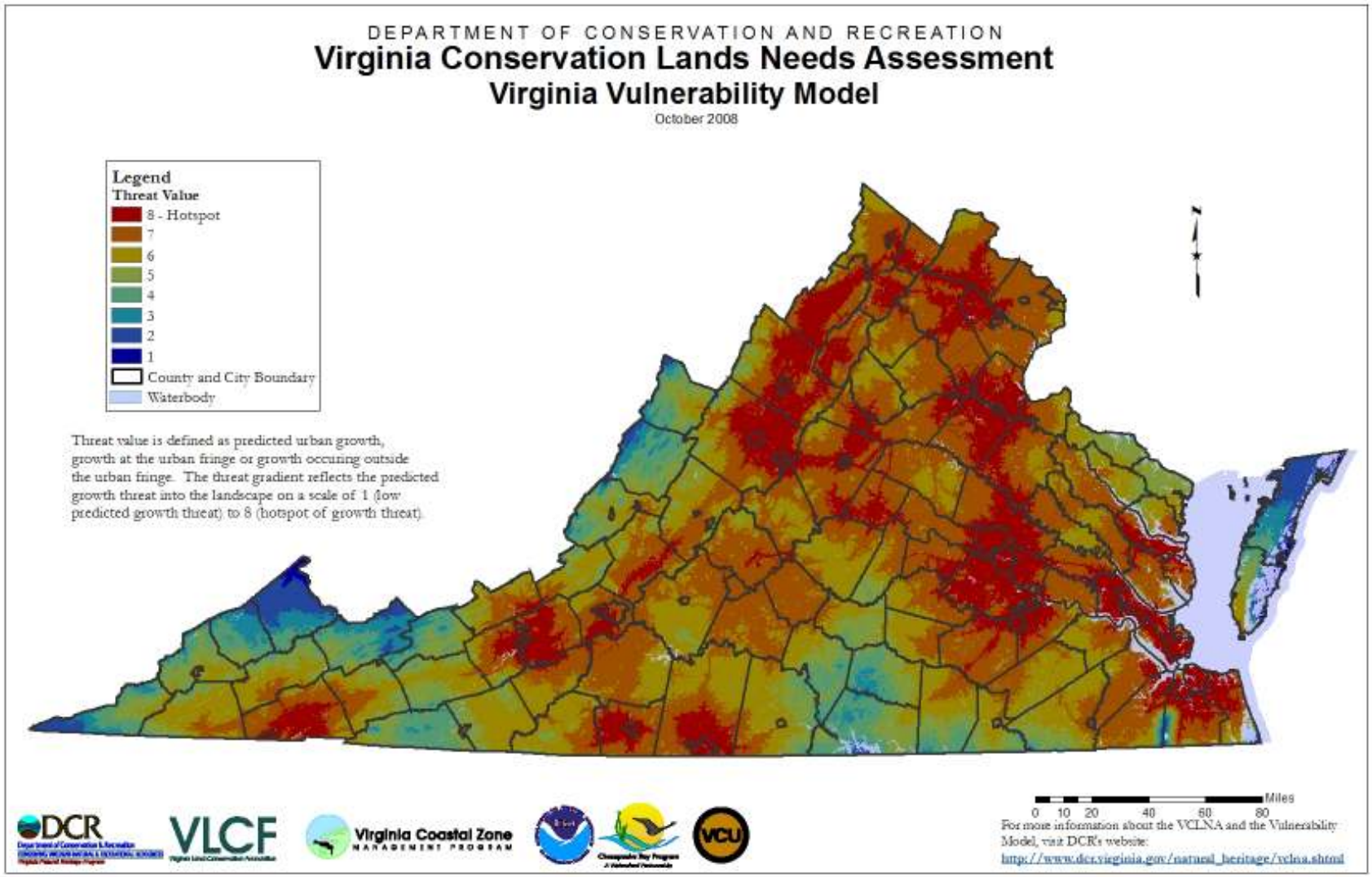


Figure 90. Virginia Urban Vulnerability Model.

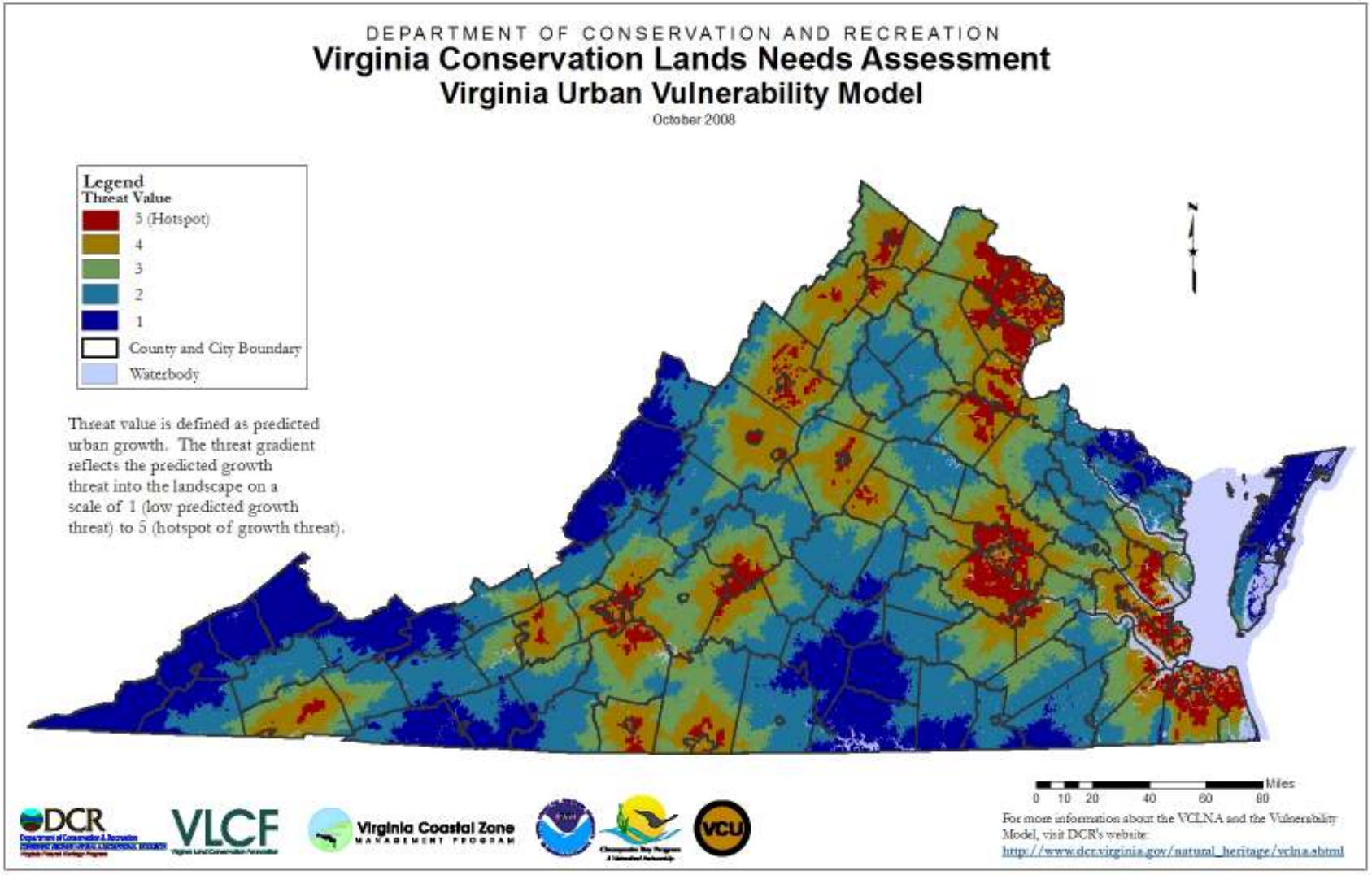


Figure 91. Virginia Urban Fringe Vulnerability Model.

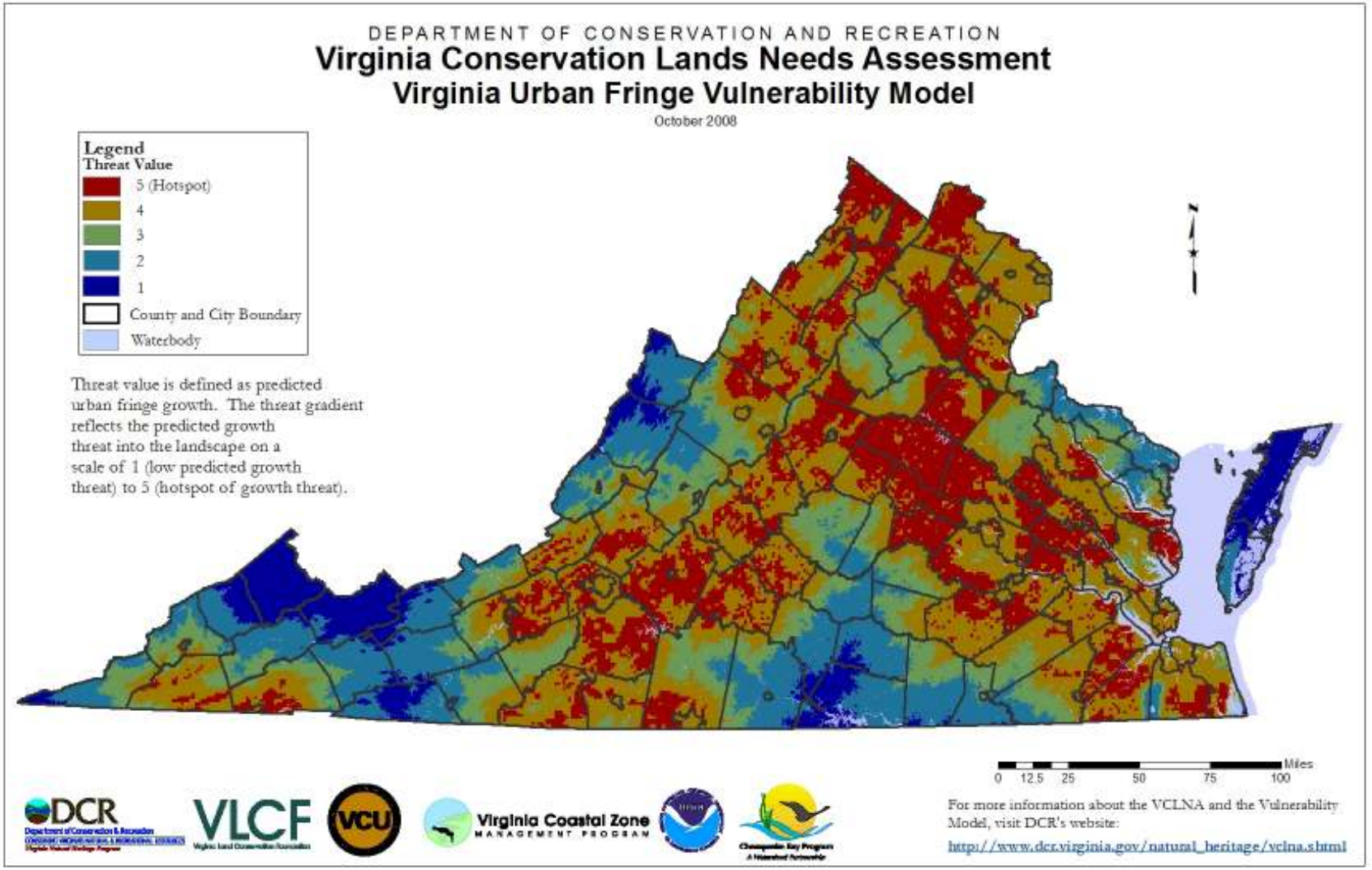
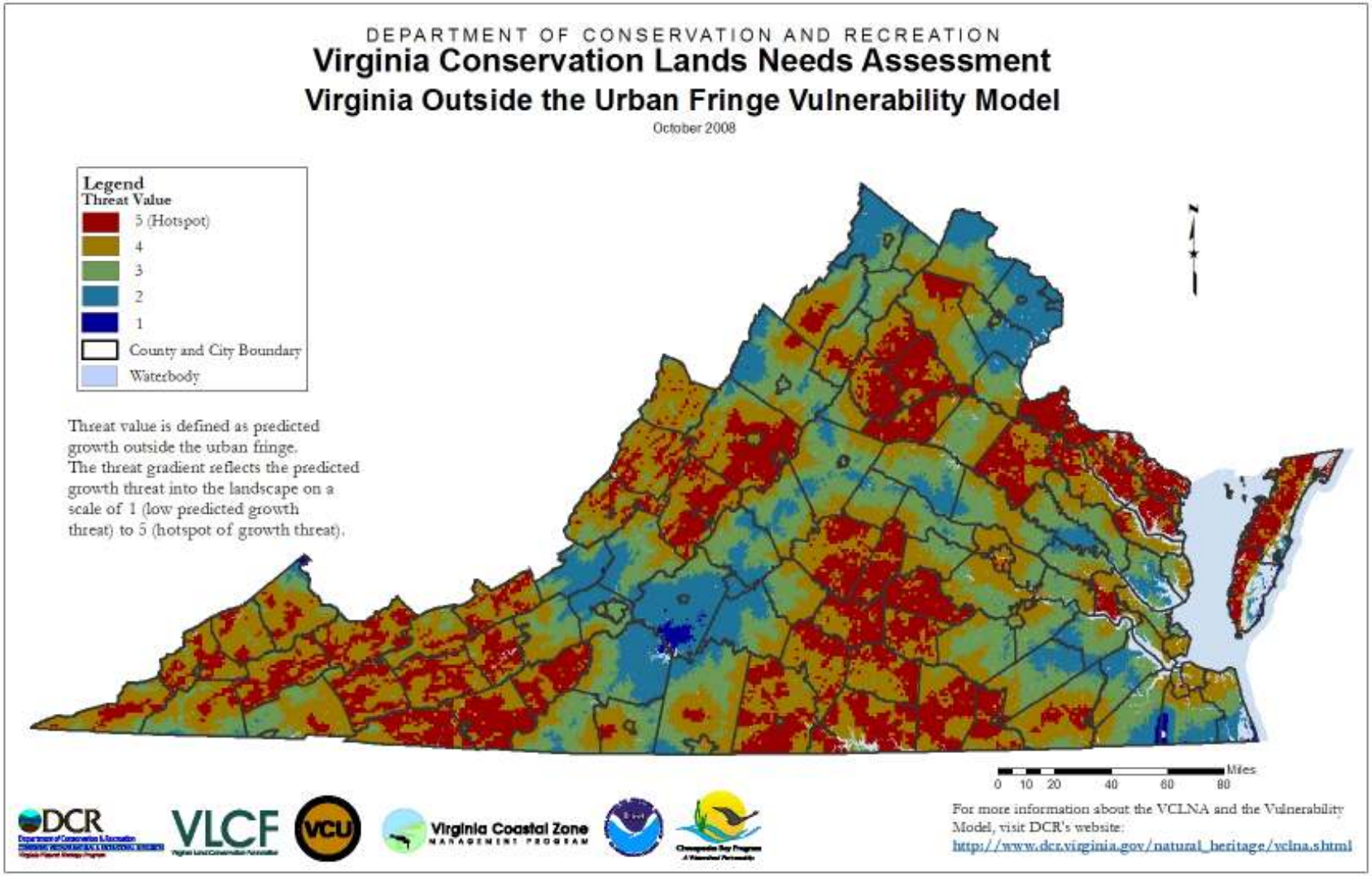


Figure 92. Virginia Outside the Urban Fringe Vulnerability Model.



Appendix # 2

Participating Entity Information

Clarke County, Commonwealth Of Virginia

Information submitted as part of FRPP application.

Background:

The Clarke County Conservation Easement Authority (CEA) was established in 2002 for the purpose of acquiring and/or receiving conservation easements, by purchase, gift, or other conveyance; to hold and enforce conservation easements conveyed to it; to administer the Clarke County Conservation Easement Purchase Program pursuant to Chapter 12 & 72 of the Clarke County Code; and to exercise any powers authorized by the Public Recreation Facilities Authorities Act. Clarke County is a local government entity. The FRPP application for FY 10, attachment A, details the CEA history, objectives, and accomplishments.

Criteria for setting acquisition priorities A ranking evaluation system was created to award points for a number of different values including: 1) agricultural value as determined by a Land Evaluation and Site Assessment (LESA) score; 2) natural resources (such as size of parcel, whether it joins a river, watershed, other permanently protected area or scenic area, etc.); and; 3) cultural or historic resources. Properties in the applicant pool with the highest point total have the highest priority. More detail on the Easement Purchase Program and scoring is in the FY10 FRPP application, attachment B.

Easement Management Experience

The "Five Year Summary of Accomplishments" report included in the FY10 FRPP application, attachment A describes the experience, management and enforcement strategies employed by the CEA. Since its inception in 2002, the CEA has accepted a total of 51 easements, 42 donated and 13 purchased, totaling 3,485 acres. A list of easements acquired in the last two years is included in Attachment A.

Staffing

The Planning Department Natural Resource Planner is responsible for administering the easement program. Additional resources include the 7 members of the CEA, the County Planning Director, and several volunteers. A handbook detailing the processes for administrating the program, accepting applications, and managing and enforcing easements provides management direction for the program is on file with FY10 application, attachment B. The County works closely with the Virginia Outdoors Foundation, a state funded agency charged with promoting the preservation of open space lands, and works towards co holding easements to further strengthen their permanent nature.

Conservation Plan

County staff has worked with Mike Liskey, District Conservationist, for many years and has a good working relationship. Mr. Liskey has worked with the farming community of Clarke County and knows

many landowners personally. The Moore and Dorsey farm does not currently have a conservation plan as the land is used for nursery production. In addition, those soils classified as highly erodible, approximately 13 acres, are on gradual slopes.

Piedmont Environmental Council

Information submitted as part of FRPP application.

The Piedmont Environmental Council is a land trust and conservation organization founded in 1972 to promote and protect the Piedmont's rural economy, natural resources, history and beauty. The organization now employs 30 full-time staff members focusing on a nine-county region stretching from Loudoun to Albemarle. We also provide support to similar organizations throughout the state of Virginia.

Since its inception, PEC has been helping landowners with conservation easements by providing technical assistance and managing easement projects. To date, PEC has helped permanently protect over 307,500 acres of land in the Piedmont region. Throughout this time, PEC has worked closely with the Virginia Outdoors Foundation helping prepare landowners for donations to this state body. In 1998, PEC acquired its first easement in partnership with Virginia Outdoors Foundation and since then has managed a robust stewardship and enforcement program.

PEC is also the fiscal agent for Virginia United Land Trust (VaULT), a coalition of 40+ nonprofits and state agencies dedicated to preservation and enhancement of working lands across the Commonwealth. Organized in 2000, VaULT's mission is to increase the effectiveness of the land conservation community in Virginia. Its purpose is to promote land conservation efforts statewide, build or create land trust capacity, coordinate statewide conservation planning, and promote high professional standards for land trusts in Virginia.

The group has adopted a Statement of Principles setting out voluntary standards for its members. Heather Richards, PEC's director of land conservation, until recently chaired VaULT's Executive Committee.

Easement Management Experience

To set land conservation priorities, PEC policy requires an environmental assessment on every tract of land or easement proposed for acquisition. Each assessment includes a physical inspection of the property, an appropriate inquiry into its historic uses, and interviews with appropriate community

leaders. Surrounding areas that could have an impact on the property are also considered. PEC's Environmental Site Assessment Form is attached as Appendix A.

PEC currently holds or co-holds 33 easements encompassing nearly 5,000 acres. These easements are held as follows:

- 10 easements held solely by PEC comprising 1,112.35 acres
- 19 easements co-held with Virginia Outdoors Foundation comprising 3,075.24 acres
- 3 easements co-held with Fauquier County comprising 740.38 acres
- 1 easement co-held with Rappahannock County comprising 55.69 acres

Potomac Conservancy

From http://www.potomac.org/site/land-protection/index.php/#landprotection on 6/22/11. Potomac Conservancy's Land Program contains two components: Land Protection and Land Restoration. Land Protection conserves lands important to water quality with permanent conservation easements. These easements restrict the use of property in order to protect conservation values, including water resources, forestland, wildlife habitat, and prime farm soils. Where possible, Potomac Conservancy strives to link protected lands into hubs and corridors to further enhance the benefits to wildlife, water quality, forest and farm sustainability, and so on.

Land Restoration focuses on ecological improvements to land, including planting trees and shrubs along streams, removing dams to improve fish passage, and constructing rain gardens to absorb and filter run-off from streets and roof-tops.

In 2010, Potomac Conservancy was officially accredited by The Land Trust Accreditation Commission, an independent program of the Land Trust Alliance. Accreditation publicly validates the high caliber of the Conservancy's land protection work and demonstrates that it meets the industry's best practices related to governance and management. The Conservancy is one of just 130 of the more than 1,700 land trusts nationwide to be approved since 2008.

Virginia Outdoors Foundation

From http://www.virginiaoutdoorsfoundation.org/VOF_about-mission.php on 6/22/11. The Virginia Outdoors Foundation (VOF) is Virginia's leader in land conservation, protecting more than 600,000 acres in 105 counties and independent cities. Since 2000, VOF has preserved open space in Virginia at a rate of about 5 acres every hour, primarily through the use of open-space conservation easements.

VOF was created by the General Assembly in 1966. It was established in the Code of Virginia under § 10.1-1800, which states: " The Virginia Outdoors Foundation is established to promote the preservation of open-space lands and to encourage private gifts of money, securities, land or other property to

preserve the natural, scenic, historic, scientific, open-space and recreational areas of the Commonwealth. The Virginia Outdoors Foundation is a body politic and shall be governed and administered by a board of trustees composed of seven trustees from the Commonwealth at large to be appointed by the Governor for four-year terms."

The creation of VOF was among the recommendations of the 1964 Virginia Outdoor Recreation Study Commission, which also suggested the creation of a Historic Landmarks Commission, a system of scenic byways, and an enlarged state park system. On June 13, 1968 the first VOF easement was recorded – 102 acres in Goochland County.

Although VOF has been in existence for nearly five decades, more than 75 percent of the current acreage protected by VOF easements has been achieved since 2000. VOF's biggest year ever was in 2006, when we protected approximately 70,000 acres. Our largest easement project to date—more than 11,000 acres on Carvins Cove in Roanoke and Botetourt counties—was recorded in 2008 and 2009. VOF's portfolio of 600,000-plus protected acres represents an area three times larger than Shenandoah National Park and more than half the size of Rhode Island.

Demand for easement in Virginia remains strong. To guide our work, the VOF Board of Trustees adopted a strategic plan in 2009. The plan seeks to balance our mission of preserving new lands with our obligation to steward the easements already under our protection. Thanks to the generosity of landowners, the strength of our partnerships, and the support of legislators, VOF will continue to fulfill its mission of preserving our shared natural and cultural resources for future generations.

VOF-Owned Lands

In 1981, the Virginia Outdoors Foundation was given the Aldie Mill Historic Site in Loudoun County. Private funds were raised and the mill was restored as an example of 19th century manufacturing. In 2006 the mill was given to the Northern Virginia Regional Park Authority, who continues to keep the mill open to the public.

On May 1, 2002, the VOF-owned Bull Run Mountains land was formally dedicated as the 34th State Natural Area Preserve. In this highly developed area, the Bull Run Mountain 2,500 acres is one of the largest, relatively intact and unfragmented natural landscapes east of the Blue Ridge in Northern Virginia.

For information about other properties owned by VOF, visit our owned-land page.

Open Space Lands Preservation Trust Fund

In 1997, the General Assembly created the Open Space Lands Preservation Trust Fund to assist landowners with the costs of conveying conservation easements. The fund has helped protect land by providing grants to reimburse a portion of the landowner's costs of donation, as well as grants which purchase a portion of the value of the landowner's easement.

VIRGINIA 2012 FARM & RANCH LANDS PROTECTION PROGRAM (FRPP)

RANKING WORKSHEET

Entity Information

Entity_____

Entity DUNS _____

Land Information

Cong. Dist _____ FIP Code _____

FSA Farm #(s) _____ Tract #(s) _____ Field #(s)_____

Size of Land Offer _____ acres

Land is eligible[i]: ☐ Yes ☐ No If no, reason why ineligible: _____

Landowner Information

Landowner Name _____ County _____

Address _____

_____

Phone _____ Tax ID # _____

Is the Adjusted Gross Income (AGI) of the Landowner ≥ $1 million? ☐ Yes ☐ No

Is 66.66 percent or more of the Landowner's AGI average *adjusted gross farm income?*

☐ Yes ☐ No

Does the Landowner/operator meet the Conservation Compliance Requirements?

☐ Yes ☐ No

Ranking Criteria

1) Percent of prime, unique, and important farmland in the parcel to be protected:

≤ 25%	0 points
26-50%	10 points
51-75%	15 points
> 75%	25 points

Score: 25 _____ **points**

2) Cultural resource consideration:

Is the site listed on the National Register of Historic Places, formally determined to be eligible for listing on the National Register of Historic Places, or listed on the State or Tribal Register of

Historic Places and will an easement protect this site from development?

☐ Yes (15 points) ☐ No (0 points)

Score: 15 _____ **points**

3) Agricultural use:

Percent of cropland, pastureland, grassland, and rangeland in the parcel to be protected.

≤ 25%	0 points
26-50%	3 points
51-75%	6 points
> 75%	10 points

Score: 10 _____ **points**

4) Funding of easement

A. USDA Funds

Requesting 50% USDA Funding	0 points
Requesting 40-49% USDA Funding	2 points
Requesting 30-39% USDA Funding	3 points
Requesting 20-29% USDA Funding	4 points
Requesting <20% USDA Funding	5 points

B. Other Sources

Landowner donation or multiple (>1) entities contributing funds to the purchase. 5 points

Score: 10 _____ **points**

5) County data:

A. Ratio of the total acres of land in the parcel to be protected to the average farm size in the county according to the most recent USDA Census of Agriculture.

County _____ Average Farm Size _____

< 1:1	0 points
1.5:1	5 points
2:1	10 points

Score: 10 _____ **points**

B. Decrease in the percentage of acreage of farm and ranch land in the county in which the parcel is located between the last two USDA Censuses of Agriculture.

County _____

0-5%	0 points
5-10%	3 points
10-15%	6 points
15-20%	10 points

Score: 10 _____ **points**

C. Percent of population growth in the County as documented by the United States Census.

County: _____

0-5%	0 points
5-10%	3 points
10-15%	6 points
15-20%	10 points

Score: 10 _____ **points**

D. Population density (population per square mile) as documented by the most recent United States Census

County _____ State_____

< State	0 points
≥ State	5 points

Score: 5 _____ **points**

6) Significance.

A. Proximity of the parcel to other protected land, including military installations, land owned in fee title by the United States or a State or local government, or by an entity whose purpose is to protect agricultural use and related conservation values, or **land that is already subject to an easement or deed restriction that limits the conversion of the land to nonagricultural use**.

☐ Adjacent (5 points) ☐ Not Adjacent (0 points)

Score: 5 _____ **points**

B. Proximity of the parcel to other agricultural operations and infrastructure?

☐ Yes (5 points) ☐ No (0 points)

Score: 5 _____ **points**

7) Local support for farmland preservation

Is the tract covered under agricultural zoning or designated agricultural use in a comprehensive plan?

Designated or zoned agricultural use	15 points
Not Designated or zoned agricultural	0 points

Score: 15 _____ **points**

8) Existence of a farm or ranch succession plan or similar plan established to encourage farm viability for future generations.

☐ Yes (10 points) ☐ No (0 points)

Score: 10 _____ **points**

9) Additional considerations.

Does the easement protect wetlands or other sensitive habitat?

☐ Yes (2 points) ☐ No (0 points)

Score: 2 _____ **points**

A. Geographic Region Location

Chesapeake Bay	3 points
Southern Rivers	0 points

Score: 3 _____ **points**

B. Are there any significant local social, economic or cultural considerations that make this tract unique?

☐ Yes (2 points) ☐ No (0 points)

Score: 2 _____ **points**

If yes, please explain:_____

10) Performance of the entity including but not limited to, managing and enforcing easements, closing efficiency and monitoring.

A) Past easements have closed within:

< 0-12 months	5 points
13-18 months	3 points
19+ months	0 points

B) Monitoring:

Once a year or more	10 points

Score: 15 _____ **points**

TOTAL POINTS _____ **points**

As a representative of _____ _____
this information is complete and accurate to the best of my knowledge.

_____
Entity Representative Date

I have verified the accuracy of this information to the best of my ability.

_____
FRPP Program Manager Date

_____

[i] 7 C.F.R. § 1491.4

Eligible land:

(1) Must be privately owned land on a farm or ranch and contain at least 50 percent prime, unique, Statewide, or locally important farmland, unless otherwise determined by the State Conservationist; contain historical or archaeological resources; or furthers a State or local policy consistent with the purposes of the program; and is subject to a pending offer by an eligible entity;

(2) Must be cropland, rangeland, grassland, pasture land, or forest land that contributes to the economic viability of an agricultural operation or serves as a buffer to protect an agricultural operation from development;

(3) May include land that is incidental to the cropland, rangeland, grassland, pasture land, or forest land if the incidental land is determined by the Secretary to be necessary for the efficient administration of a conservation easement;

(4) May include parts of or entire farms or ranches;

(5) Must not include forest land of greater than two-thirds of the easement area. Forest land that exceeds the greater of 10 acres or 10 percent of the easement area shall have a forest management plan before closing;

(6) NRCS shall not enroll land in FRPP that is owned in fee title by an agency of the United States, a State or local government, or by an entity whose purpose is to protect agricultural use and related conservation values, including those listed in the statute under eligible land, or land that is already subject to an easement or deed restriction that limits the conversion of the land to nonagricultural use, unless otherwise determined by the Chief;

(7) Must be owned by landowners who certify that they do not exceed the adjusted gross income limitation eligibility requirements set forth in part Code of Federal Regulations Title 7 Part 1400;

(8) Must possess suitable on-site and off-site conditions which will allow the easement to be effective in achieving the purposes of the program. Suitability conditions may include, but are not limited to, hazardous substances on or in the vicinity of the parcel, land use surrounding the parcel that is not compatible with agriculture, and highway or utility corridors that are planned to pass through or immediately adjacent to the parcel; and

(9) May be land on which gas, oil, earth, or other mineral rights exploration has been leased or is owned by someone other than the applicant may be offered for participation in the program. However, if an applicant submits an offer for an easement project, USDA will assess the potential impact that the third party rights may have upon achieving the program purposes. USDA reserves the right to deny funding for any application where there are exceptions to clear title on any property.